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Committee on the Peaceful Uses of Outer Space

Obtrusive space advertising and astronomical research

Background paper by the International Astronomical Union

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I. Introduction

1. In its resolution 56/51 of 10 December 2001, paragraph 15 (c), the General Assembly endorsed the recommendation of the Committee on the Peaceful Uses of Outer Space that the Committee's Scientific and Technical Subcommittee consider the issue of international cooperation in limiting obtrusive space advertising that could interfere with astronomical observations at its thirty-ninth session. At its thirty-eighth session, the Scientific and Technical Subcommittee agreed that space-related scientific organizations such as the International Astronomical Union (IAU) should be invited to conduct a background study on the subject and present the results to the Subcommittee to facilitate its work (A/AC.105/761, annex II, para. 19).

2. The present background paper by the International Astronomical Union has been submitted in response to this request.

II. Background

3. Astronomy is one of the oldest fascinations of the human mind. From the dawn of humanity, humans have contemplated the sky and the motions of the heavenly bodies. Their studies of the Sun and Moon gave us the calendar: the day, the month, the seasons, and the year, which govern short- and long-term survival and prosperity in cultures based on hunting or farming. Astronomy thus became not only a practical tool, but also a key element in the organizational and religious structure of many civilizations throughout human history.

4. The intricate motions of the planets in the sky were also charted already thousands of years ago, providing both the motivation and the foundation for the drive to understand the structure of the universe as it was then understood, i.e. the solar system. The path towards this goal led directly to the discovery of the law of gravitation, the finite speed of light, and the dynamical consequences of general relativity—cornerstones of modern science. Pursuing the quest towards ever more distant horizons eventually led to the modern, grand and richly detailed physical picture of the cosmic evolution which led from the birth of the universe to that of mankind. Yet, the recent discovery of other planetary systems—very different from our own—serves to remind us that vast scientific horizons still remain unexplored.

5. Along this intellectual journey, astronomy has been instrumental in shaping modern empirical science, based on reproducible measurements and verifiable physical laws. Unable to experiment with their objects of study, astronomers must rely on observations of ever-increasing sophistication, diversity and sensitivity. Today, objects in the farthest reaches of the universe are being studied at all wavelengths of the electromagnetic spectrum, from gamma and X-rays via visible and infrared light to radio waves. Front-line telescopes and detectors on the ground and in space routinely study objects that are 100 million times fainter than any visible with the naked eye, and all the energy collected by the world's radio telescopes in the 50-year lifespan of radio astronomy would only suffice to light a flashlight bulb for a fraction of a second. Yet the key questions of cosmology require continued progress in sensitivity, and no fundamental limit is in sight.

III. Environmental impacts on astronomy

6. Astronomical observations are made against a background of natural and artificial signals. The faintest galaxies now studied are only about one per cent as bright as the natural light of even the darkest night sky, due about equally to atmospheric airglow and sunlight scattered by dust in the solar system. Radio observations of such faint galaxies are made against a radio background from such sources as the Sun, Jupiter, and the centre of the Milky Way. Careful choices of wavelength ranges and sophisticated observational techniques normally allow these natural obstacles to be overcome.

7. Unfortunately, human-induced degradation of the environment has made astronomical observations at all wavelengths increasingly difficult in recent decades. Ground-based light pollution has increased to the point where 90 per cent of the population of the United States of America or the European Union lives under a sky that is at least twice its natural brightness, according to the recent "First world atlas of the artificial night sky brightness".[1] Two thirds of the populations of these regions never see a sky darker than a full-moon night, which makes deep-sky astronomy impossible, and half have already lost naked-eye visibility of the Milky Way. Many developing countries are similarly affected.

8. In the radio domain, developments have been no less dramatic: If one of today's ubiquitous mobile

telephones were placed on the Moon, it would be among the four brightest sources in the radio sky, and the cosmic sources studied in front-line research are millions of times fainter than this. Radio astronomers are being denied access to increasing parts of the electromagnetic spectrum, also because unwanted emissions from other users spill into bands reserved for radio astronomy by the International Telecommunication Union, overwhelming the vastly fainter astronomical signals.

9. For over a century, astronomers have acted to avoid these disturbances by moving both optical and radio observatories into increasingly remote regions of the world. The symptoms of economic progress have followed them there, but agreements with enlightened national Governments and local authorities have often created a harmonious coexistence between the astronomers and the local population. For example, reducing (electric) light pollution plainly saves money as well as facilitating the progress of science—a true win-win situation.

10. However, the increasing activity in outer space has caused a qualitative change in the environmental conditions for astronomy. Scattered light from sunlit spacecraft and space debris, and radio noise from communications satellites and global positioning systems in space, reach the entire surface of the Earth. No place is sheltered from these disturbances, and a pristine sky is no longer to be found anywhere on Earth, including developing countries. Already, this loss is irreversible.

11. Astronomers are seeking support to limit the rate of growth of this pollution of the sky. The odds are daunting, inasmuch as the actions of any player in space may affect astronomy throughout the world, and deregulation and privatization of space services complicate the regulatory situation considerably. Yet, international agreements have been successfully negotiated to limit environmental problems with even greater financial and political implications than those of astronomy.

IV. Advertising in space

12. Advertising is among the activities with potentially adverse effects on the space environment. The tremendous qualitative difference from traditional forms of advertising is that no nations or individuals can refuse to be exposed to space advertising, which might be considered undesirable for scientific, aesthetic, political, or even religious reasons. As advertising is generally intended to enhance the profits of an enterprise, this may be viewed as an advantage of space advertising, but it is hardly an activity conducted "for the benefit of all mankind", and its potential adverse effects should be weighed accordingly.

13. Advertising on radio and television is already being distributed from broadcasting satellites in space. Although ubiquitous, it can still be avoided by turning off receivers at home or by visiting national parks or similar reserves. In contrast, the visible light from obtrusive advertising, defined as "advertising in outer space that is capable of being recognised by a human being on the surface of the Earth without the aid of a telescope or other technological device",[2] is inescapable. Once in place it imposes on all and, depending on its orbital characteristics, may do so for thousands of years.

14. In fact, most space advertising is likely to greatly outlast the enterprise that launched it, unless end-of-mission deorbiting procedures are required and implemented. Moreover, because space objects used for advertising purposes need to be very large, they also present a large cross-section to impacts of existing space debris, resulting in the creation of even more such debris.

V. Obtrusive space advertising projects in the past

15. The last two decades have seen a number of projects that were clearly in the category of obtrusive space advertising. Even more projects have appeared which were marketed as artistic, celebratory, or technological feasibility projects, but the true nature of which proves to be advertising upon closer examination. A number of these are briefly described below. From the viewpoint of astronomy, it is a fortunate fact that none of these projects was actually implemented as planned, due to technical failures or lack of political and/or financial support. Thus, there still remains time to act before the world finds itself with a fait accompli.

16. The potentially most devastating proposal for a clear-cut space advertising project, by Space Marketing Inc. (Georgia, United States), was aptly named the "Space Billboard". About one square kilometre in dimension, it would have rivalled the full Moon in size and brightness. "Obtrusive" is a fitting description indeed, and when visible it would have obliterated most astronomical

observations. Moreover, it was estimated to receive some 10,000 impacts of space debris per day, with associated debris proliferation. A project for a similar reflector of 1,000 x 400 m size was proposed for the Olympic Games in Atlanta in 1996. In the end, however, none of these projects were able to attract the required funding.

17. Space objects that would have provided even brighter illuminations (some ten times that of the full Moon) were the Russian solar reflectors Znamya 2 and 2.5. These large deployable mirrors were intended to provide winter illumination in polar regions. Yet, the demonstration flights in 1993 and 1999 would have illuminated a number of cities in Europe and the United States and would thus have served primarily to advertise the system itself. However, both attempts to unfold the mirrors failed, so the performance of the system was never verified in practice. But proponents of even larger space solar power projects remain active worldwide.

18. Smaller-scale projects were proposed which formally had celebratory purposes, but with strong implicit elements of advertising. "The Ring of Light" was a French project to launch a ring of bright satellites to celebrate the bicentennial of the revolution and the centennial of the Eiffel Tower in 1989. The "Star of Tolerance" (also French), a pair of very large tethered balloons in low orbit which would have become as bright as Venus at maximum, was formally intended to celebrate the fiftieth anniversary of the United Nations Educational, Scientific and Cultural Organization (UNESCO) in 1999, but was in reality a thinly disguised space advertising enterprise. In the end, both projects were abandoned after vigorous international opposition.

19. A final example of space advertising presented under another label is the project initiated in the 1980s by the Celestis Corporation (Florida, United States) to launch cremated human remains into space in shining cylinders. The project was delayed due to a conflict with local Florida legal regulations, but continued later through launches from California. Fortunately, the project has been modified so that capsules with cremated remains are not dispersed into space, but stay fixed inside the last stage of the satellite launcher. However, the orbital lifetime of these stages at circular orbits between 600 to 900 kilometres is relatively long. So far, there have been three successful launchings into Earth orbit (21 April 1997, 10 February 1998 and 21 December 1999). The latest attempt on 21 September 2001 was unsuccessful and the next launch is scheduled for mid-2002.

VI. Obtrusive space advertising: general considerations

20. It will appear from these examples that whereas the term "obtrusive" is clear and unambiguous, the definition of "advertising" is far from obvious. Certainly, the formal purpose of a project as stated by its originators is not an adequate criterion. However, the projects mentioned above, whether or not their true purpose was explicitly advertised, share two characteristics. First, they had no factual scientific or technical function such as telecommunications, observations of Earth or space, apart from attracting the attention of people on Earth. Second, the flow of revenues would go only to the originators of the project. It would appear that the combination of these two characteristics might form the nucleus of an internationally agreed definition of space advertising.

21. It is noted that no definitions of "obtrusive space advertising" would include the usual agency or company logos on spacecraft (which are not visible from the ground), nor such space vehicles as telecommunications satellites, even if they may be commercial projects and disseminate advertising from space.

22. It is also noted that "obtrusive space advertising" by no means encompasses all artificial space objects which have a negative impact on astronomy. A large number of spacecraft already in orbit and launched for a wide variety of purposes are sufficiently bright to have a damaging effect on astronomical observations in that region of the sky, the International Space Station being the most prominent example. For the purposes of this discussion, it will be assumed that their benefit to national or international interests is perceived to outweigh their adverse effects.

VII. Obtrusive space advertising: astronomical classification

23. The severity of the impacts of obtrusive space advertising may be classified according to a few basic characteristics of the corresponding space object:

(a) Brightness as seen from the surface of the Earth;

(b) Time of visibility from a given observing point on Earth;

(c) Extent and positional control of the illuminated area on Earth.

24. The brightness of a space object as seen from a ground-based observatory is clearly the main parameter determining its impact on the observations. Essentially, any object that is visible with the naked eye will ruin an astronomical observation conducted in the same direction. For the faintest, fast-moving objects, recovery may be possible through multiple exposures and digital filtering, as is already necessary to cope with existing satellites and space debris. However, the brightest such objects—as bright as or brighter than Venus or Jupiter—may damage the ultra-sensitive detector systems used on large telescopes. Protection of large telescopes by separate monitoring of the field for bright moving objects may soon become necessary.

25. In contrast, any object of a brightness comparable to the full Moon will, like the real Moon, generate so much scattered light in the Earth's atmosphere that observations of all faint objects become impossible. Whether or not such a disturbance would spell the end of ground-based observational cosmology depends on the temporal and geographical extent of the illumination. Space observatories would be immune to only some of this type of pollution, but are also so costly and specialized that the future of astronomy cannot be based on space observatories alone.

26. The fraction of night-time in which an object is visible is another key parameter. Objects which are visible and/or bright only in evening or morning twilight are generally less detrimental to astronomy than objects which remain visible all night. Importantly, however, observations of other sunlit objects, such as near Earth asteroids inside the Earth's orbit or space debris, must also be done at twilight and would suffer directly from a proliferation of bright objects at that time.

27. From a practical point of view, the most economical way to create a luminous object in the sky is to launch a highly reflecting surface in low orbit. The brightness and visibility of the object can be enhanced by increasing its size and optimizing its surface properties. The limitations of this type of illumination to the twilight hours can be alleviated by raising the object to a higher orbit, well out of the Earth's shadow, and/or by installing artificial illumination on the spacecraft. Both of these techniques raise the complexity and cost of the experiment considerably.

28. Finally, the size and position of the illuminated area are of importance. If an object illuminates the entire dark hemisphere of the Earth, all night-time astronomy suffers in proportion to the brightness of the illumination. However, some experiments are intended to intensify the illumination by focusing it, through the use of mirrors, onto a geographical area of limited size. Hence, if control could be maintained over the position of this area, astronomical observatories and other sensitive sites, such as national parks, could in principle be kept free of unwanted illumination. However, first, this would require precise on-board control mechanisms for the mirrors, including fallback systems in case of malfunctions. Second, there remains the issue of a suitable international mechanism to define the protected sites and enforce the regulations.

VIII. Previous international efforts to protect astronomy

29. As the main international scientific organization in the field of astronomy, IAU has made sustained efforts to call attention to the deterioration of the environment and its effects upon the future of astronomy. The general assemblies of IAU, held every three years, have for forty years in their resolutions advocated measures to prevent adverse space activities in either the optical or the radio region, or both. The pollution of the sky affects astronomy in developing and developed countries alike, and IAU serves as the international advocate for astronomy throughout the world.

30. In fact, as early as 1961, the IAU General Assembly "viewed with great concern the grave danger that some future space project might seriously interfere with astronomical observations in the optical as well as in the radio domain" and "appealed to all Governments to refrain from launching [such projects] until it is established beyond doubt that no danger will be done to astronomical research". In 1970, the IAU General Assembly recalled and reaffirmed this resolution, referring specifically to the United Nations Outer Space Treaty,[3] in particular to its articles IV and IX, a stand that was repeated and re-emphasized in following years.

31. Notwithstanding, problems continued to increase and the twentieth IAU General Assembly in 1988 appealed to the International Council of Scientific Unions (ICSU) and its Scientific Committee on Problems of the Environment (SCOPE) to take up this aspect of the

general problem of the degrading environment. A special meeting, IAU Colloquium 112, Light Pollution, Radio Interference, and Space Debris,[4] was also held to discuss and highlight the specific problems and outline suitable countermeasures. This was followed up again in 1992 by the high-level International Symposium on the Adverse Environmental Impacts on Astronomy, organized jointly by IAU, ICSU, UNESCO and the Committee on Space Research (COSPAR), and resulting in the volume *The Vanishing Universe*[5] in which, for the first time, specific high-level strategic goals were defined and a plan for pursuing them was laid out.

32. As one initiative resulting from the 1992 conference, IAU applied for status as Permanent Observer with the United Nations Committee on the Peaceful Uses of Outer Space. This was granted in 1994, and subsequent IAU efforts have been made in cooperation with the Committee. Thus, a Technical Forum, the International Astronomical Union/Committee on Space Research/United Nations Special Environmental Symposium "Preserving the Astronomical Sky",[6] was organized in conjunction with the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III) in 1999. The meeting presented its recommendations[7] to the main Conference, and the Space Millennium: Vienna Declaration on Space and Human Development adopted by UNISPACE III contains corresponding policy guidelines for future activities in space "before further irreversible actions are taken affecting future utilization of near-Earth space or outer space".[8] These recommendations apply also to obtrusive space advertising.

IX. Policy recommendations

33. The future of astronomy clearly depends on the extent to which it will be possible to limit the degradation of the space environment. Obtrusive space advertising is one such grave concern for the future. Unlike several other forms of adverse environmental impact, however, there is still time for prevention before irreversible damage to astronomy is done.

34. IAU therefore appreciates and applauds the measures taken by the United States of America to prohibit the granting of a launch licence to any form of such advertising.[2] As outlined above, this measure alone will by no means guarantee that astronomy will be free of interference from activities in space, be it in the optical or in the radio domain. But prohibiting space advertising that would be visible by the vast majority of the world's population will undoubtedly greatly reduce the financial incentive to engage in such projects. This initiative should therefore be followed up by other spacefaring nations.

35. Accordingly, IAU recommends for the consideration of the Committee on the Peaceful Uses of Outer Space:

(a) That Member States should be encouraged to adopt similar legislation on obtrusive space advertising, so that this activity is regulated by all space-faring nations;

(b) That international guidelines to limit the environmental impact of space activities on astronomy be developed by the Committee, in close cooperation with IAU, to ensure that uniform principles are applied to the definition of projects to which this legislation would apply.

Notes

[1] P. Cinzano, F. Falchi and C. D. Elvidge, *Monthly Notices of the Royal Astronomical Society*, vol. 328 (2001), pp. 689-704.

[2] United States code, title 49, chap. 701, sect. 70109a.

[3] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (General Assembly resolution 2222 (XXI) of 19 December 1966).

[4] D. L. Crawford, ed., *Light Pollution, Radio Interference, and Space Debris (IAU Colloquium 112)*, conf. series 17 (San Francisco, Astronomical Society of the Pacific, 1991).

[5] D. McNally, *The Vanishing Universe* (Cambridge University Press, 1994).

[6] R. J. Cohen and W. T. Sullivan, III, eds., *Preserving the Astronomical Sky (IAU Symposium 196)* (Astronomical Society of the Pacific, 2001).

[7] *Report of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space, Vienna, 19-30 July 1999* (United Nations publication, Sales No. E.00.I.3), annex III, chap. II.

[8] Ibid., chap. I, resolution 1, para. 1 (c) (v).

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Committee on the Peaceful Uses of Outer Space

International cooperation in the peaceful uses of outer space: activities of Member States

Note by the Secretariat

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I. Introduction

1. In the report of its thirty-eighth session, the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space agreed that the Secretariat should continue to invite Member States to submit annual reports on their space activities (A/AC.105/761, para. 17).

2. Pursuant to that recommendation, in a note verbale dated 8 August 2001, the Secretary-General requested Governments to submit reports by 31 October 2001 so that they could be submitted to the Scientific and Technical Subcommittee at its next session. The present note has been prepared by the Secretariat on the basis of information received from Member States by 14 December 2001. Information received subsequent to that date will be included in addenda to the present document.

II. Replies received from Member States

Algeria

[Original: French]

1. Following the participation of Algeria in the work of the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space at its thirty-eighth session, held in Vienna from 12 to 23 February 2001, the Government of Algeria submitted an official request to the Office for Outer Space Affairs expressing its desire to participate in the work of the Committee as a regular member.

2. Algeria, which fully subscribes to the treaties and principles of the United Nations regarding outer space and is doing its part to promote international space law, hopes through its participation in the work of the Committee to strengthen the role of its space policy within the framework of its scientific and technological programmes.

1. Algerian Space Agency

3. Apart from their value in dealing with problems of international security, satellite data are becoming increasingly important for actions and decisions bearing on the management of natural disasters and natural resources, as well as providing valuable assistance in connection with forecasting and long-term planning. Satellite data thus provide a valuable source of geographical information on the country's own territory and the areas surrounding it, and it is vital for an integrated approach to questions of national development that this information should be kept up to date.

4. Aware as it is of this necessity, Algeria has decided to establish a national space programme in this strategic area. The law launching this programme establishes a five-year plan of scientific research and technological development. This political will is reflected in the project for the creation of an Algerian Space Agency, which should help the country to strengthen its national capacities in economic and social development, knowledge of natural resources, environmental protection and the prevention and/or management of major disasters. This Agency,

which is the body responsible for formulating and implementing a national policy for the promotion and development of space activities, will have, among others, the following tasks:

(a) To study, elaborate and propose to the Government the basic features of a national strategy in the area of space activity and to implement that strategy;

(b) To establish a space infrastructure capable of strengthening national capacities with a view to ensuring development of the national community;

(c) To study and define the modalities and means of developing space technologies and promoting their use in the different sectors of interest;

(d) To pave the way for bilateral and multilateral cooperation with other national authorities in meeting its own objectives and to arrange for exchange of information and technical assistance with foreign partners;

(e) To promote the peaceful exploitation and use of outer space.

2. National Centre for Space Technology

5. In this context, the Arzew National Centre for Space Technology (CNTS), apart from its duties in relation to training, has emphasized two particular types of research within its overall research and development programme, namely small satellite technology and space instrumentation.

6. This project of the CNTS, called the "ALSAT Project", provides a framework within which the institution has been able to improve its grasp of the disciplines related to space technology and to gain mastery in this area step by step.

7. The design and manufacture of the Algerian microsatellite ALSAT and its preparation for flight are being carried out in close collaboration and under contract with the Surrey Space Centre in the United Kingdom of Great Britain and Northern Ireland.

8. The Algerian satellite ALSAT-1 will be part of a constellation of five satellites belonging to China, Nigeria, Thailand and the United Kingdom in addition to Algeria. The project was launched on 25 October 2001, and the Algerian project team has already gone to the Surrey Space Centre. Also foreseen among the activities connected with this project is academic training for Algerian specialists (at the PhD and Masters levels) in disciplines closely related to small satellite technology. The programme launched by Algeria could then, with time, become part of an integrated worldwide space system for the management of natural disasters.

3. Navigation and positioning technologies

9. Various national bodies and private operators are at present using modern methods of navigation and positioning. The most common of these are the global positioning system (GPS), inertial navigation systems, radio navigation systems such as the differential global positioning system, beacons and so on.

10. This, then, is a brief review of Algeria's space activities. This is an area that will need qualitative improvements if its is to respond adequately to the needs of the national community in matters of social and economic well-being.

Argentina

[Original: Spanish]

1. The National Commission for Space Activities (CONAE), which is attached to the Ministry of Foreign Affairs, International Trade and Religion, is the Argentine space agency, which coordinates all activities connected with the peaceful uses of outer space. CONAE is currently executing the National Space Plan for 1997-2008.

2. The cornerstones of the National Space Plan are constituted by the following facts:

(a) Argentina is a country that, owing to its particular characteristics, makes and will make intensive use of space science and technology;

(b) An analysis of the different "products" that space activities contribute to social and economic development reveals the importance for the country of the generation of complete space information cycles and the identification of the respective applications.

3. The National Space Plan has been conceived as an investment project where, on the basis of fiscal returns, it is possible to determine rationally the internal rate of return of the Plan, which is proving very advantageous for the country.

National Space Plan

4. Under the general guidelines of the National Space Plan, entitled "Argentina in Space", it is necessary to revise the Plan periodically (normally every two years) and, on each such occasion, its scope must be extended for an equivalent period so that there is always a target period of at least one decade. In the course of each revision, the Plan is adapted in line with the country's capacities and requirements and with the progress made during the previous biennium, with an evaluation of the operations to be continued and the addition or deletion of projects or activities as appropriate. For such purposes, it is necessary to take particular account of global advances in space technology, the relevance of new concepts and the developments and achievements in cooperation programmes that have been implemented.

5. Recent years have shown a substantial increase in the supply of information provided by space resources internationally. This growth in international information-sharing is linked to a large extent to increasing global awareness of the need for continuous monitoring of the environment, natural resources and changes stemming from human activity, as well as emergency management, together with the free use of previously restricted technologies.

6. As a result of this increase in the international supply of information, the effects of which will become apparent on a very wide scale over the next five years, the need has arisen for the development of new ways and means of gathering, processing, analysing and using information, with particular emphasis on the last two activities, which are connected with research and development operations and with the development of human resource skills. In order to generate the complete space information cycles, CONAE is undertaking activities and projects in the following five action areas:

Ground infrastructure

Satellite systems

Information systems

Access to space

Institutional development and basic operations.

7. The following sections describe activities in each action area.

1. Ground infrastructure

(a) Ground station for satellite tracking, telemetry and command and for data acquisition in the Province of Córdoba

8. Since 1998 the station has been operational for the purposes of satellite tracking, telemetry and command, using one antenna with a diameter of 4.0 metres and one with a diameter of 13 metres. The second antenna, together with an additional one of 7.3 metres and several new antennas, also has satellite data acquisition capacity.

9. With regard to satellite image reception, data are now received routinely from the satellites Landsat 5 and 7, ERS 2, Orbview (SeaWIFS), the NOAA series, EROS A1, SAC-C and Radarsat. Data reception from EO-1, IRS-1C and 1D and Radarsat is due to start up in the near future.

10. The station's processing capacity has been continually upgraded and now allows synthetic aperture radar products to be generated less than five minutes after the passage of the satellite. In the event of natural and other emergencies, a dedicated link for 16 Mbytes/s allows data to be transferred to Buenos Aires in just a few minutes.

11. The data input system does not make use of recorders. Since all the instruments of the reception system and the antennas are controlled remotely, it is possible to interrupt reception, acquire data from another satellite passing simultaneously and return to the first satellite in automatic mode.

12. With regard to satellite tracking, telemetry and command, the station was used during 1999 for carrying out the Argentine SAC-A mission and operated in July and August 2000 as the main station for the Italian Advanced Technology Micro-Satellite (MITA) mission on the basis of an agreement with the Italian Space Agency (ASI). Since November 2000 it has been operating as the control centre for the Argentine SAC-C satellite.

(b) New ground station for data acquisition and satellite tracking, telemetry and command

13. Work has been completed on the design and development of a second ground station in the Province of Tierra del Fuego, in the extreme south of the American continent. This ground station is to be installed under agreements with ASI and the Italian-Argentine Satellite System for Emergency Management (SIASGE).

(c) Multi-beam and multi-band systems

14. Work has started on the design of advanced multi-beam and multi-band systems for simultaneous reception from several satellites.

2. Satellite systems

15. In the area of remote sensing applications, provision is made in the National Space Plan for two series of satellites: the scientific applications satellite (SAC) series, with instruments in the optical range; and the observation and communications satellite (SAOCOM) series, with instruments in the microwave range.

(a) SAC-C satellite mission

16. The SAC-C satellite, Argentina's first Earth observation satellite, was placed in orbit on 21 November 2000 and began receiving data from the Córdoba Ground Station as soon as engineering work was completed. Under a cooperation agreement between CONAE and the National Aeronautics and Space Administration (NASA) of the United States of America, the SAC-C satellite forms part of the Matutina Constellation for Earth observation, composed of the Argentine SAC-C and the United States satellites Landsat 7, Terra and EO-1.

17. The main payload of the SAC-C satellite is made up of a multispectral medium-resolution scanner (MMRS) provided by CONAE, a set of magnetometers for scalar and vectoral measurements of the Earth's magnetic field (magnetic mapping payload), designed and built by a consortium consisting of the NASA Jet Propulsion Laboratory (NASA/JPL) and the Danish Space Research Institute (DSRI), and the GPS Occultation and Passive Reflection Experiment (GOLPE) provided by NASA/JPL.

18. In addition, the SAC-C is equipped with a panchromatic high-resolution tracking camera and a high-sensitivity tracking camera, both developed by CONAE, two technological test assemblies provided by Italy (the Italian Star Tracker (IST) and the Italian Navigation Experiment for SAC-C (INES)), a French instrument to determine the effect of high-energy particles on advanced electronic components, an Argentine experiment to determine the migratory route of the southern right whale (also known as the franca whale) and an environmental data collection system made up of a network of stations distributed throughout Argentina.

19. Data received from the SAC-C satellite are used to study the terrestrial and marine environment, assess desertification, monitor flooding, forecast agricultural production, monitor the atmospheric temperature and vapour content of water with a view to determining the variability of the atmospheric structure, perform measurements of the geomagnetic field with the same level of accuracy attained by observatories, measure atmospheric space radiation and its effects on advanced electronic components, determine the migratory route of the southern right whale and verify methods used in determining satellite attitude and velocity.

20. The SAC-C satellite is scheduled to be succeeded by the SAC-D.

(b) SAOCOM missions (main payloads in the microwave range)

21. SAOCOM is a satellite mission composed of the SAOCOM 1A and 1B satellites, whose main payload is a polarimetric synthetic aperture radar in the L-band (1.3 GHz). The SAOCOM 1A is scheduled to be launched in 2004 and the 1B in 2005.

22. Particular emphasis in this mission has been placed on advanced applications, such as radar interferometry and the uses of different polarizations for improved identification of terrain characteristics.

23. In February 2000, an agreement was signed with ASI to establish SIASGE, under which the satellites in the Argentine SAOCOM series will operate jointly with the Italian SkyMed-COSMO satellites to provide information relevant for emergency management.

24. In October 2000, a special agreement was signed with the Space Centre in Liège for Belgian participation in the SAOCOM project through the joint development of a processor.

25. In March 2001, a declaration was signed between CONAE and ASI to extend cooperation under the SIASGE system to the installation of a ground station in Tierra del Fuego, cooperation regarding the Gulich Institute and the possible inclusion in SIASGE of the CONAE satellites SAC-C and SAC-D.

3. Information systems

26. This action area is designed primarily to ensure appropriate management of the gathering, reception, transmission, storage, processing, use and dissemination of information derived from space or through the use of space resources. The activities are centred on remote sensing issues to a large extent, in particular the identification of the requirement to be met in order to generate complete space information cycles.

(a) Applications for emergencies

27. In this area, CONAE is developing methodologies to meet each specific need. In particular, it is collaborating with the Federal Emergency System of the Argentine Republic (SIFEM) by furnishing information derived from space to the bodies comprising SIFEM for use in the management of natural disasters and emergencies caused by human activity. Space information is crucial for monitoring, damage evaluation, vulnerability mapping, logistical planning and so forth in emergencies such as flooding, droughts, environmental pollution, fires, landslides, coastal flooding, algal blooms, crop pests, desertification, earthquakes, tornadoes and volcanic eruptions.

(b) Terrestrial validation

28. Work is continuing on the creation of a database containing spectral signatures of the main areas under cultivation and relevant geographical parameters on the basis of a planning operation covering different geographical zones of the national territory. In 2001, the United States Airborne Visible Infrared Imaging Spectrometer (AVIRIS) was deployed for the calibration of the SAC-C and EO-1 satellites.

29. In addition, geometric validation of the Landsat 7 satellite was performed at level 5.

(c) Satellite image distribution and promotion of satellite image applications

30. The Unit for Satellite Image Distribution and Promotion of Satellite Image Applications has been in operation since 1998. A catalogue of images can be accessed via the CONAE web site www.conae.gov.ar.

(d) Data-gathering networks

31. Development of a data-gathering network using the SAC-C satellite has commenced.

4. Access to space

32. Under Decree No. 176/97, the National Executive instructed CONAE to incorporate the item "Means of access to space and launch services" into the revision of the National Space Plan on an equal basis with the generation of complete space information cycles.

33. This has been achieved by making the relevant amendments to the "Access to space" action area by the appropriate means and mechanisms, in conformity with the current national and global technological situation and in line with Argentina's foreign policy, its non-proliferation policy and the international undertakings assumed by Argentina in that connection, and by encouraging a gradual and continuous increase in the country's intellectual and technological participation. In accordance with the provisions of Decree No. 176/97, the advanced technology development work will be carried out within a framework of complete transparency and in close liaison with national bodies and international organizations in countries that are members of the Missile Technology Control Regime (MTCR), primarily with Brazil.

34. In 2001, CONAE firmed up its plans for the joint construction and testing of a prototype liquid fuel engine with the National Atomic Energy Commission (CONEA). In collaboration with Brazil, work was continued on the project, consisting of the sub-orbital flight of a payload manufactured by CONAE on board a Brazilian sounding rocket.

5. Institutional development and basic operations

35. This action area has the following objectives:

(a) To establish links with scientific, technical and business institutions in order to promote research and development in the different spheres of space science and technology;

(b) To promote the development and use of specialized human resources in the development and application of space technology in education and industry;

(c) To establish international cooperation plans to help achieve the objectives of the National Space Plan;

(d) To raise public awareness of the importance of space activities and their benefits for society.

(a) Cooperation with national institutions

36. The National Space Plan involves the participation of various Argentine scientific, technological and industrial bodies. Agreements signed with these bodies provide for the supply of satellite images by CONAE, the training of personnel to work with these images and the provision of equipment.

(b) Human resources development

(i) J. M. Gulich Institute for Advanced Space Studies

37. On 25 July 2001, CONAE opened the Mario Gulich Institute for Advanced Space Studies, housed in the Teófilo Tabanera Space Centre in the Province of Córdoba. The Institute will provide postgraduate courses that are the first of their kind in Argentina, providing training in the use of space information, within the academic framework of the National University of Córdoba. In addition, through an agreement signed by CONAE, the J. M. Gulich Institute has been established as the academic arm of SIFEM.

38. The Institute aims to provide training for Argentine personnel in the prevention and management of natural disasters and emergencies caused by human activity, in the interpretation of the state of the natural environment and in the use of state-of-the-art applications of space technology in the area of health care, most specifically in relation to general epidemiology in the evaluation of risks of epidemic outbreaks of illnesses carried by vectors such as mosquitoes and rodents.

39. In addition, it is proposed to develop projects aimed at pushing forward the frontiers of knowledge with regard to the application of space science and technology in the areas of health and environmental emergencies and to promote and organize activities and events to foster collaboration between national institutions concerned with subjects related to the Institute's area of study.

40. In order to ensure the viability of this programme in terms of information technology, steps have been taken to upgrade cooperation between CONAE and Italy in order to facilitate access to supercomputers with high processing capacity.

(ii) Educational projects

41. CONAE is developing various educational projects aimed at disseminating basic knowledge of the Earth, its space environment and artificial satellites, and familiarizing students and teachers at different educational levels with the manipulation of satellite images to allow them access to the current activities being conducted under the National Space Plan. These include the transmission of images from SAC-C and Landsat, together with training in their use. CONAE is also participating in the Space Experiment Module programme, through an agreement with NASA, which gives students an opportunity to send their experiments into space.

(c) Scientific activities

42. Other significant activities include the continuation of the Total Ozone Mapping Spectrometer's Earth Probe Programme for ozone measurements from satellites, in cooperation with NASA and the National University of Rosario;

development of schemes to measure ultraviolet radiation from Atacama Plateau to Tierra del Fuego; and evaluation of erythemic dose and solar risk factors. The regular operation of a light direction and ranging system for atmospheric aerosol and ozone profile measurement has been initiated at the Laser Research and Applications Centre, where a system for data collection via the Aeronet network has been set up under a CONAE/NASA agreement.

43. CONAE has continued to participate in the ChagaSpace project, involving the search for drugs to combat Chagas' disease, in cooperation with NASA, the Institute of Parasitology attached to the Ministry of Health and Social Welfare and research institutes in Brazil, Chile, Costa Rica, Mexico and Uruguay.

(d) International cooperation

44. CONAE provides necessary support to the National Executive on specific topics, such as MTCR and the National System of War Material and Sensitive Imports and Exports, pursuant to Decree No. 603/92.

45. In 1995, the National Registry of Objects Launched into Outer Space was set up, and CONAE was designated the authority responsible for its administration. The entries relating to the SAC-A and SAC-C satellite were recorded in 1998 and 2000, respectively.

46. In accordance with the National Space Plan, the projects being developed by CONAE involve a high degree of cooperation with other countries. This takes the form of partnerships between the two parties involved in the project, with the partners providing proportionate inputs without any differentiation of levels of responsibility, whether in technical matters or in terms of the scope of the general commitments undertaken.

47. Since its foundation in 1991, CONAE has signed cooperation agreements with NASA of the United States, ASI of Italy, the Brazilian Space Agency (AEB), the German Aerospace Centre (DLR), the Centre national d'études spatiales (CNES) of France, National Institute for Aerospace Technology (INTA) of Spain, the Federal Office for Scientific, Technical and Cultural Affairs (SSTC) and the Space Centre in Liège in Belgium, the British National Space Centre (BNSC), the National Space Agency of Ukraine (NSAU), and DSRI of Denmark as well as with the European Space Agency (ESA), and it is negotiating agreements with other countries.

Australia

[Original: English]

1. The year 2001 has been another landmark year for the Australian space sector, with the Government strengthening its commitment to develop a competitive environment for the industry. In doing this, the Government is aiming to capitalize on Australia's unique advantages and the projected growth in global space activities.

2. Australia's space science, technology and industry capability is spread across both government and industry sectors, and ranges from fundamental research programmes to advanced commercial applications. The Department of Industry, Science and Resources retains primary responsibility within the Government for the

development and implementation of Australia's space policy. Other government agencies and organizations involved in space activities include the Australian Surveying and Land Information Group, the Australian Centre for Remote Sensing, the Department of Communications, Information Technology and the Arts, the Department of Defence, and the Bureau of Meteorology.

3. The key activities undertaken by the Government in 2001 included the finalization of the space safety regime, finalization of regulations to facilitate the operation of the commercial space industry (the Space Activities Regulations 2001), issuing the first instrument under the Australian Space Activities Act 1998, signature of a major international agreement on space cooperation with the Russian Federation, facilitation of several major commercial launch projects, the completion of a future plan for the Australian spatial information industry, as well as extensive remote sensing and meteorological science and technology activities.

1. Licensing regime

4. Central to the Government's commitment to achieving a competitive environment for the Australian space industry is the continuation of efforts directed at creating an effective legal and regulatory framework for commercial space activities in Australia. This regime will also ensure a safe environment for space launch activities and consistency with the country's international obligations, including its responsibilities under the United Nations Convention on International Liability for Damage Caused by Space Objects.

5. The Space Activities Act 1998 (the Act) establishes a legal basis for the operation of commercial spaceports in Australia and the conduct of launches, including those conducted by Australian nationals from overseas sites. It also provides for recovery operations and investigation procedures in the event of an accident.

6. The space safety regime forms an integral part of the licensing regime, and is intended to protect public life and property. The regime is one in which risks are identified, assessed and managed, consistent with the risk to the public being as low as reasonably practicable.

7. The Australian Government finalized the Space Activities Regulations 2001 (the Regulations) in the middle of the year. The Regulations provide further direction regarding the licensing regime for space activities, and include an outline of information to be submitted to facilitate assessment of an application for the licences and permits needed to undertake space-related activities, the process for assessment of applications, details of fees attached to instruments, and methodologies to be employed to demonstrate that the risk of harm to the public is as low as reasonably practicable. The Act, Regulations and information to be provided according to these documents will also ensure that the application and assessment process is open, accountable and transparent.

8. The Government recently announced that amendments would be made to the Act and Regulations to ensure that additional protection is afforded to key national assets. Amendments to liability arrangements will also be made, with a cap being put in place on the level of insurance to be procured by a space launch proponent and the Government accepting liability for claims above this of up to 3 billion Australian dollars ($A). This liability cap will only apply to claims under Australian domestic law and will not affect Australia's obligations under international law. The

Government will also amend the Act to provide for a new Scientific and Educational Activity Certificate, which would provide a licensing mechanism which is less onerous and more suited to the modest scale and limited risks associated with scientific and educational launches and returns.

9. Guidelines are currently being developed to assist industry to comply with the licensing regime.

2. Space Licensing and Safety Office

10. The Space Licensing and Safety Office, within the Department of Industry, Science and Resources, has responsibility for implementing the licensing regime established by the Space Activities Act 1998, Regulations, guidelines and any other agreements entered into by the country for the licensing of commercial space launch projects.

11. The role of the Space Licensing and Safety Office is to administer the regulation of the emerging commercial space launch industry for the safety of the Australian and international communities. Ventures wishing to conduct space activities in Australia, or Australian ventures wishing to conduct such activities overseas must seek approval under the legislation by presenting a case to the Space Licensing and Safety Office.

12. In October 2001, the Space Licensing and Safety Office issued its first instrument under the Act in respect of test launches at Woomera in South Australia.

3. International cooperation

13. Commercial launch projects that are developed in Australia often involve technology and equipment sourced from other countries. To facilitate the transfer of technology and expertise, as well as provide for scientific and commercial activity, a framework for international cooperation is required. Australia is a party to all five United Nations space treaties. In addition, it has in place bilateral agreements with a number of countries and agreements with a number of international space agencies that provide a framework for cooperative space-related activities.

(a) Agreement on Space Cooperation with the Russian Federation

14. In May 2001, the Australian Government signed a bilateral agreement with the Government of the Russian Federation relating to the exploration and use of outer space for peaceful purposes. The Agreement, which has a commercial focus, creates a legal and organizational framework for joint space activities between the two countries. The Government is now negotiating two subsidiary agreements with the Government of the Russian Federation.

4. Commercial proponents

15. There are a number of proposals to develop commercial space launch facilities in Australia currently under development. Firm proposals include those listed below:

(a) Kistler Aerospace Corporation, Woomera, South Australia

16. The Kistler Aerospace Corporation is developing a two-stage reusable launch vehicle, known as the K-1, for the low Earth orbit (LEO) satellite market and International Space Station resupply missions. This cost-effective vehicle is designed to return to the launch site and can be relaunched within nine days. Kistler was the first commercial space proposal in Australia to receive environmental approval, in March 1998. The company anticipates conducting up to 25 launches per annum once the site is fully operational.

(b) Asia Pacific Space Centre, Christmas Island, Indian Ocean

17. The Asia Pacific Space Centre (APSC) is an Australian company founded in 1997 to establish a satellite launch facility at Christmas Island. APSC will use the Russian Aurora rocket as its primary launch vehicle. The launch vehicle will consist of three stages, plus an optional upper stage, and will target geostationary launches. Launch site construction is expected to commence late in 2001, with 12 launches per annum planned to commence in 2004.

18. APSC also proposes to establish a space research centre that will offer post-graduate teaching and research in collaboration with other Australian and international research institutions.

19. Subject to APSC meeting certain obligations and milestones, the Government will provide $A 100 million to assist with the provision and upgrade of common use infrastructure.

(c) Spacelift Australia Limited, Woomera, South Australia

20. Spacelift Australia Limited proposes to establish a commercial space transportation business at Woomera, South Australia, based on the Russian "Start" family of vehicles, which combines high accuracy, reliability and cost competitiveness with the high security of the launch site within the Woomera Restricted Zone. Spacelift would provide a "precision" launch vehicle for the global small LEO market, and proposes to commence commercial operations in 2003.

5. Research projects

21. Several Australian research organizations are involved in new rocket and satellite research, development and launch projects.

(a) FedSat-1

22. The Cooperative Research Centre for Satellite Systems (CRCSS) facilitates the involvement of local industry and government agencies in services based on the application of small satellites. CRCSS is funded by a combination of corporate, government and individual sponsors.

23. The Centre's main project is the construction and launch of a low cost microsatellite, known as Federation Satellite One (FedSat-1), which will carry experiments in the fields of navigation, magnetic field measurements, communications, profiling the Earth's atmosphere, and testing new space computers. The project will give Australian scientists and engineers valuable data

about the space environment, as well as experience in space engineering and the practical application of space technologies.

24. FedSat-1 is scheduled for launch in 2002 on a Japanese HII-A launch vehicle.

(b) HyShot

25. The HyShot project consists of two sub-orbital launches to validate hypersonic wind tunnel test and computational techniques used in scramjet engine research. The scramjet engine payloads have been designed and manufactured by the University of Queensland. The launch vehicle is a two-stage Terrier-Orion unguided sub-orbital launch vehicle provided by the Astrotech company of the United States.

26. The project, which has received government funding and support, puts Australia at the cutting edge of global scramjet research. Scramjets have possible commercial applications in satellite launching and in hypersonic aviation. While use of this new technology for civil aviation purposes is still some way off, scramjets would most likely be used in the near future to supplement rockets for satellite launches, due to their low weight and high efficiency. NASA and the United States military have shown considerable interest in the HyShot experiment.

(c) Ausroc

27. The Australian Space Research Institute Ltd., which is a non-profit public company that aims to further space science and technology in Australia, conducts the Ausroc programme. The goal of the Ausroc programme is to develop a low-cost microsatellite launch vehicle, utilizing technologies that can be scaled up for use in heavier launch vehicles. The programme is structured in four stages, each of which will prove the technologies and systems that can then be incorporated into the successors.

(d) BLUEsat

28. Undergraduate students from the University of Western Sydney, with further participation from graduates, industry, educational institutions and space enthusiasts, are developing the BLUEsat project. The project encompasses the design, construction and operation of an amateur communications microsatellite utilizing store-and-forward packet radio. The project also aims to carry an experimental imaging payload and experimental altitude and positioning sensors. The launch is scheduled to take place by mid-2002.

(e) JAESAT

29. The Joint Australian Engineering Satellite (JAESAT) project was created in 1997, by the Australian Space Research Institute, CRCSS and the Queensland University of Technology, to design, construct, launch and operate a microsatellite. A launch date of mid-to-late 2002 is planned on a Dniepr 0-1 launch vehicle.

(f) Kitcomm

30. Kitcomm is a satellite-based asset management and tracking system enabling the transfer of data to and from low-cost, fixed and mobile Kitcomm terminals, supporting a wide variety of applications. The Kitcomm system will be deployed in

2001 and 2002 and will require three space launches to deliver its 21-satellite constellation into polar orbits. The system will provide a global, continuous-cover service.

(g) ARIES

31. The Australian Resources Information and Environment Satellite (ARIES) is a proposed LEO satellite that will provide hyperspectral data for mineral, environment and other purpose-specific mapping.

32. ARIES is the outcome of 20 years of collaborative research and development into advanced remote sensing technologies between Australia's leading research agency, the Commonwealth Scientific and Industrial Research Organisation, and the mining industry. It is being designed as an Australian owned and managed fully commercial satellite to provide new and unique information to customers on a global basis. Sophisticated new algorithms will allow more precise identification of sub-pixel components, which will allow the generation of a new range of theme-specific maps.

6. Industry development

(a) International Space Advisory Group

33. In 2001, the Australian Government convened the International Space Advisory Group to identify opportunities for Australian involvement in the International Space Station and other international space programs, and to assess the potential scientific and commercial benefits in pursuing such opportunities. The Group comprises leaders from Australian space-related industry and research sectors and Government representatives.

34. The Group is preparing a report for Government consideration in early 2002, detailing strategies to enhance international collaboration and build on the skills and capabilities of our domestic industry.

(b) Spatial information industry

35. Over the last year, the Australian Government has worked with industry, other levels of government, and educational and research institutions to develop a blueprint for the future of the Australian spatial information industry. In 2001, a joint government and industry report was produced, entitled "Positioning for growth", which outlines strategies and actions to promote the development of the industry. As a result of the industry-government collaboration process, the Australian Spatial Information Business Association was formed to represent business interests of the industry.

36. The agreed strategies and actions include developing a joint policy framework, improving data access and pricing, increasing effective research and development, evaluating and reforming education and skills formation strategies, and developing domestic and global markets.

37. A number of new markets are emerging in the spatial information industry, particularly through the development of business applications for geographic information and global positioning systems. These applications present new

opportunities for improving customer services, delivering new products and refocusing Australian business activities to improve technology uptake. The report agrees to the provision of free access to online government-held fundamental spatial data, including information about land use, dry-land salinity risk, geology, gravity, seismic activity, climate, World Heritage areas, the Register of the National Estate, and 1:1-million-scale digital topographic data covering the whole of Australia.

7. Conclusion

38. The past year was a significant one for both the Australian Government and the domestic space industry. Through a number of domestic and international initiatives, Australia has signalled its intention to become a key player in the global space arena and is putting in place the frameworks to facilitate this.

Brazil

[Original: English]

1. The efforts undertaken in recent decades by the Brazilian Government resulted in the consolidation of an active space sector comprising leading institutions of research and development, operational centres, and technology enterprises and universities, acting in a systemic way under the coordination of the Brazilian Space Agency.

2. As an example of the Brazilian technological advancement, it may be highlighted that Brazil is among the few countries having successfully developed satellites. Brazil possesses an operational satellite launching centre and will soon have its own satellite launching vehicle.

3. In the year 2001, the National Programme of Space Activities continued to deploy efforts to increase the capacity of Brazil to develop and utilize space technology for the solution of issues relevant to Brazilian society, aiming at the mastery of critical technologies. The present report outlines the main space-related activities carried out in Brazil in the year 2001.

4. The Brazilian Government continued its efforts to establish the necessary conditions for the commercial utilization of the Alcantara Launching Center.

5. The Executive Branch of the Brazilian Government presented to the National Congress the text of the Convention on Registration of Objects Launched into Outer Space for the respective approval and eventual accession by Brazil to the Convention.

6. The Brazilian partnership in the development of the China-Brazil Earth Resources Satellite (CBERS) made important progress in 2001. CBERS is a joint project with China to develop two high-performance satellites for optical remote sensing of the Earth. CBERS-1 has been in orbit since October 1999; the second China-Brazil Earth Resources Satellite, CBERS-2, is undergoing final tests in order to be launched by a Chinese Long March 4 rocket in the first half of 2002. Brazil and China are presently envisaging the possibility of signing an agreement to build two additional CBERS satellites that will feature optical sensors more advanced than in the previous two satellites. This would mean there would be no interruption

of the services provided by the series of CBERS satellites. In this context, it is important to emphasize the growing capacity of Brazil in terms of satellite image acquisition.

7. Among other important achievements is the conclusion of tests of the Humidity Sounder for Brazil (HSB). The main objective of this equipment is to study atmospheric humidity profiles, with applications in meteorology. HSB is a passive microwave radiometer that will fly on the Aqua satellite of the NASA Earth Observing System (EOS) programme, together with four other sensors supplied by Japan and the United States. The equipment is now being integrated and tested in the satellite, which is scheduled to be launched in early 2002.

8. With reference to Brazilian participation in the International Space Station, domestic steps and actions have been taken for the development of the equipment to be furnished by Brazil. Another important initiative was the training of a Brazilian astronaut, Major Marcos Cesar Pontes, at the NASA Johnson Space Center. Preparatory training has been initiated for his first flight, which in principle should take place in 2005.

9. Joint studies have advanced towards the concept of an Argentinian-Brazilian remote sensing satellite dedicated to applications in agriculture, water resources and environment monitoring, and the inclusion of Spain as a possible partner has also been contemplated. Negotiations are being held towards the signature of a framework agreement in the space area with ESA.

10. Another important initiative was the establishment in São José dos Campos, São Paulo, of the regional Centre for Space Science and Technology Education for Latin America and the Caribbean (CRECTEALC). The Microgravity Workshop in the area of Life Sciences, held in Rio de Janeiro on 17 and 18 July 2001, was another important initiative taken by Brazil.

11. Concerning the educational area, some training and dissemination activities have been carried out or are under way: the EDUCA SeRe Project, for the development of remote sensing teaching in the basic and high school levels using CBERS images; a course for schoolteachers (IV Course on Remote Sensing for Environmental Applications); an Introduction to Astronomy and Astrophysics; the II Remote Sensing Data Users Meeting at the National Institute for Space Research (INPE) Cuiabá, with a lecture on the EDUCA SeRe Project; responsibility for technical advice to the Space Bus Project, designed for students at the grammar school and high school levels; the annual Space School course, from 3 to 13 November 2001 at INPE; local organization of the Committee on Space Research (COSPAR) Regional Workshop for Latin American Data Processing from the Chandra and XMM-Newton Space Missions from 4 to 13 December 2001, INPE.

12. The country's size and economic dimensions, with a variety of climate characteristics, large areas with agricultural activity, some highly concentrated areas of population and industrial production, and the largest area of tropical forest in the world, make evident the importance of weather and climate forecasting for Brazil. In this context, the Brazilian effort in weather and climate forecasting includes a supercomputer facility at the INPE Centre of Weather Forecasting and Climate Studies (CPTEC). CPTEC/INPE activities include operation of ground stations for detection and processing of satellite imagery provided by the NOAA-12, -14, -15, -16, and the GOES-E and Meteosat satellites.

13. Until 2002, EOS-AM and -PM files will be operationally available. Research and development efforts are devoted to generating satellite products, on an operational basis. Sub-orbital experiments are of great scientific and technological interest. One important class of such experiments explores microgravity conditions reproduced in parabolic flights in order to carry out research of great potential in areas such as biology, crystal growth, new materials, medicine, fluid dynamics, basic physics and combustion.

14. In the field of high-energy astrophysics, several balloon-borne experiments to detect X-rays and gamma rays from cosmic sources have been developed and flown. Currently, Brazil is ready to launch a large gamma-ray imaging telescope, MASCO, developed and tested over the last few years. Brazil is also starting the development of a scientific satellite mission, MIRAX, in collaboration with several foreign institutions. The mission will be devoted to the study of X-ray transients and explosive phenomena as well as to monitoring the spectral and timing behaviour of a large fraction of the X-ray sky with unprecedented resolution and sensitivity.

15. In the field of optical astronomy, Brazil has designed and built several instruments, including a high-speed UBVRI photometer, a charge-coupled device (CCD) fast photometer and, in particular, a high-resolution and large-field infrared camera (CamIV), which is being operated at the telescopes of the Brazilian National Lab for Astrophysics. In the radioastronomy field, several important projects have been developed. In particular, the Brazilian Decimetric Array, a large interferometric experiment, is being designed in collaboration with several foreign institutions. Other important research carried out in Brazil includes the development and operation of the first spherical resonant mass gravitational wave antenna, with state-of-the-art technology, in collaboration with several laboratories worldwide.

Finland

[Original: English]

1. Administration

1. The organizations involved in the space activities are described below.

Organization	*Place in government*	*Major activities*
National Technology Agency (Tekes)	Reports to the Ministry of Trade and Industry	Established in 1983, it is responsible for Finland's relations to ESA, global and bilateral space cooperation, space technology programmes, and funding and implementation of the technological and industrial part of the Finnish space programme. Secretariat for the Finnish Space Committee.
Finnish Space Committee	Inter-ministerial coordination body, reports to the Ministry of Trade and Industry	Established in 1985, it is responsible for drafting national space policy. Appointed by the Government for a three-year mandate period (2001-2004).
Academy of Finland	Reports to the Ministry of Education	Provides financing for the space science programme.

2. The update of the Finnish space strategy for 2002-2004 is foreseen by the end of 2001. This work is performed by the Finnish Space Committee. Space activity funding is also received from several other ministries.

3. There are over 33 companies and research units in Finland that do business in satellite equipment supply chains or study space technology. There are seven universities in Finland that study remote sensing or space science.

2. Outlook

4. Finnish space activity started in the early 1980s, first through bilateral cooperation with the former Union of Soviet Socialist Republics on instruments for the Phobos Martian probe, and then with Sweden for the Tele-X telecommunications project. In 1987, Finland became an associate member of ESA, becoming an ESA member State in 1995.

5. ESA programmes are the main focus, and the strategy is to concentrate on selected areas like remote sensing, telecommunications, satellite navigation, technology research and development programmes and space science.

3. Budget trend

6. The Finnish space budget has been quite flat since 1995, although the share devoted to ESA programmes began to increase at this time. The ESA contribution accounted for the main part of the budget in 2001. The Finnish space budget is expected to remain at a constant level over the next years.

7. Finnish space funding mainly comes from Tekes. Its contribution amounted to €20 million in 2001.

4. National activities

8. Finland's main interests in space focus on Earth observation, science and applications and space science (primarily solar system research, high-energy astrophysics and cosmology). Data provided by polar orbiting satellites (NOAA, ERS-2) are largely used for sea-ice mapping and water-quality monitoring, and imagery from the Landsat and SPOT satellites has been used for inventories of land use and vegetation since 1975.

9. The ANTARES space science programme started in April 2001 and ends in 2004. It is jointly funded by Tekes and the Academy of Finland. It funds 11 research consortia that study Earth observation science and space science. The total cost of the programme is at least €10 million.

5. Ongoing international programmes and projects

Organization/country	*Finnish involvement*
ESA	
SOHO	Two instruments
Cluster II	Power supply units, two instruments
Huygens	Titan lander radio altimeter
XMM	Telescope tube structure and mirror thermal control unit
Integral	Participation in JEM-X X-ray monitor (detectors)
Mars Express	Power supply units, participation in instruments
Rosetta	Primary structure, power distribution system's units, instruments
Belgium, ESA	Space debris detectors and DPU on PROBA
Sweden	Microwave instrument on ODIN
France, ESA	GOMOS instrument for Envisat
The Netherlands/United States	OMI instrument on NASA's EOS-Aura
Italy	SAX X-ray instrument hardware
United States	NASA TWINS mechanisms
	NASA Cassini mechanisms instrument
	NASA HETE II X-ray instrument
	ISS debris instrument
	NASA NEAR X-ray instrument
	NASA Stardust instrument participation
Japan	ISS X-ray instrument
Russian Federation	Silicon X-ray array for spectrum-X-G
	MetLander Mars-landers
China, France, Germany, Italy, Russian Federation, Spain, Switzerland, United Kingdom, United States	Alpha magnetic spectrometer—particle physics experiment on the International Space Station (search for antimatter)
	Finland: silicon tracker, ground support and data handling

Iran (Islamic Republic of)

[Original: English]

1. Introduction

1. The Islamic Republic of Iran is a wide country in a strategic and important region in the world, with a variety of natural resources, environments, climates, cultures and people. To manage the country well and to use its resources and potential for improvement and sustainable development, the authorities pay great attention to the use of efficient, modern and economic tools to support their plans for the above-mentioned purposes.

2. It has long been realized that space science and technology applications play a significant role in the promotion of the sustainable development of the country. For nearly a decade, the Islamic Republic of Iran has accelerated its efforts and has taken steps towards the application of space science and technology to benefit from extensive and wide-ranging advantages of the peaceful uses of outer space in its ongoing long-term and short-term development plans.

3. Based on the activities carried out during the last three decades in different agencies, at present the institutionalization of a national body with the aims of policy-making, planning, budgeting, research, development and coordination of ongoing activities in different organizations within the country is going to be finalized. In this respect and in order to coordinate all of its activities in research institutions, administrative agencies and universities, the policy-making process is being carried out carefully for an ultimate goal of being the core of the foreseeable Iranian National Space Agency.

2. Space policy

4. Based on the specific conditions and geographic location, the Islamic Republic of Iran trusts that space technology and its applications can make a significant contribution to overcome the problems of the development of the country. Using space science and technology, the Islamic Republic of Iran aims towards the following achievements:

(a) Commercialization and broadcasting, Earth observations, environmental change observations, climate prediction, survey and mapping, among others;

(b) Human resource development for implementation of space development in the future;

(c) Acquisition and mastery of space science and technology directed to support the development of space applications and industrial activities;

(d) Encouragement of space activities in the private sector in order to familiarize the public with space activities and integrate them into daily life;

(e) Promotion of space science and technology among the Iranian youth, who will play a key role in the future of the country;

(f) Establishment of a space information system at the national level;

(g) Promotion of international cooperation based on principles of mutual benefit and reciprocity.

3. Capacity-building

5. There are various institutes and agencies in the Islamic Republic of Iran that are currently carrying out space activities according to their functions and areas of interest.

6. To build the capacity required to develop and extend its activities in different areas of the peaceful uses of space, including satellite communication, resource investigation and satellite-based positioning systems, satellite meteorology and natural disaster monitoring, space science and technology, the Islamic Republic of Iran is not only currently taking required measures to provide required facilities,

hardware and software, but is also extending its educational activities both using national resources and through the implementation of bilateral regional or interregional cooperation projects.

7. Presently, there are more than seven universities that are holding postgraduate courses or degree programmes in space remote sensing and geographic information systems. In addition to these universities, other administrative bodies such as the National Cartographic Center (NCC), the Iranian Remote Sensing Center (IRSC), and the Soil Conservation and Watershed Management Research Center are providing discipline-oriented or special courses on new space technologies.

8. To further their existing knowledge and to remain up-to-date in their own fields of interest, Iranian specialists regularly participate in short-term and long-term courses supported by the Economic and Social Commission for Asia and the Pacific (ESCAP) or offered by other regional or international bodies such as the Centre for Space Science and Technology Education for Asia and the Pacific (CSSTE-AP), the Inter-Islamic Network on Space Science and Technology (ISNET) and the Japan International Cooperation Agency (JICA). Attending different seminars, symposia, conferences and workshops is also playing an important role to promote existing expertise of Iranian scientists.

9. World Space Week celebrations, which were held for the second time in early October, constitute another basic step for capacity-building for space science and technology applications in the country.

4. Natural resource monitoring and geomatics

10. The background for the country's involvement in applications of space remote sensing techniques and utilization of data acquired by Earth observation satellites dates back to the launch of the first commercial Earth observing satellites (Landsat series).

11. Nowadays, the Earth resources monitoring and management agencies are not only using almost any available data taken by various Earth resources satellites, but are also equipped with the most advanced facilities available for data analysis and integration of data through the use of geographic information systems.

12. The main agencies involved in Earth resources remote sensing activities include IRSC (which acts as the national coordinating body), the Geological and Mineral Research Survey of Iran, affiliated to the Ministry of Mines and Metals, the Forest and Range Organization, the Soil Conservation and Watershed Management Research Center, the Ministry of Jihad of Agriculture, the Iranian National Center for Oceanography, the Ministry of Energy, the Ministry of Petroleum, and the Ministry of Science, Research and Technology.

13. To expand its capabilities and to make it compatible with the increasing demand for newly acquired remotely sensed data from space, the Islamic Republic of Iran has decided to establish a Multi-Mission Remote Sensing Ground Station with both S- and X-band frequencies, capable of receiving data acquired by existing and future satellites. In this regard, the receiving station for data acquisition from the TERRA satellite's medium-resolution MODIS sensor was put into service early this October in IRSC.

14. In addition to activities mentioned above, NCC, a national body responsible for topographic base maps and data production, is using GPS, which is basically designed for navigation services, for projects including the Triangulation Networking and National Leveling Project and its subsequent linkage with regional and international GPS networks, the National 1:25,000-scale Topographic Mapping Project, geodesic surveying projects, accurate levelling projects, and the Determination of the Geoid of the Islamic Republic of Iran.

15. In addition to NCC, the National Geographical Organization of the Islamic Republic of Iran is also enjoying invaluable archives of various types of satellite imagery, which has enabled it to offer technical services to other administrative bodies in the country.

5. Satellite meteorology and natural disaster monitoring

16. The weather satellite receiving system PC SAT for Meteosat primary data user station, secondary data user station and NOAA automatic picture transmission was installed at the Islamic Republic of Iran Meteorological Organization (IRIMO) headquarters in early 1992. The major highlight in operational changes is that IRIMO expanded the receiving station with high-resolution picture transmission and meteorological data dissemination units in 1998.

17. Data taken by meteorological satellites are used by the IRIMO forecasting centre not only for weather forecasting purposes but also for atmospheric disaster mitigation objectives.

18. Receiving facilities for the NOAA satellites are also installed in the Iranian National Oceanographic Center and IRSC. While advanced very-high resolution radiometer data received by the IRSC acquisition system are used for Earth resources monitoring and studies, and results and documents are disseminated in the public domain, data received by two other specialized agencies are used for their own studies and research projects.

19. In addition to atmospheric disasters, the National Committee on Natural Disaster Reduction, within the framework of a joint research project, is using space-based positioning systems to monitor plate movements along major active faults in Khorasan Province (in the north-eastern part of the country) and Tehran region, areas having historical and recent earthquake records and reactivation potential. The project is being carried out through a trilateral effort including the Geological and Mineral Exploration Survey of the Islamic Republic of Iran and NCC.

6. Satellite communication and broadcasting

20. The telecommunication network in the Islamic Republic of Iran is essentially based on a microwave backbone with reasonable coverage in the well-populated provinces. The total number of operating telephone lines is now about 7 million, meaning a penetration of some 14 lines per 100 people. There are about 300,000 cellular mobile phone subscribers, a capacity of 12,000 ports in the data network and more than 75,000 public payphones throughout the country. International communication is mainly handled through the INTELSAT and Inmarsat satellite networks by more than 3,500 channels via three international gateway earth stations.

21. The national Domsat system was put into service in 1990 by implementing phase 1, which consisted of 7 hubs and 61 terminals configured in 7 star sub-networks. The technology employed therein was single channel per carrier quadrature phase shift keying frequency division multiple access, through transponders of the Ku-band east spot of the INTELSAT 63° E satellite. The ground segment was later augmented by the installation of two star networks comprising two hubs and 900 very-small aperture terminals (VSAT) accessing the same satellite through the time division multiple access technique. In addition, a separate nationwide network consisting of two hubs and some 1,700 VSATs owned and operated by the Central Bank of the Republic of Iran is now in service.

22. Recently, a tender has been issued by the Telecommunication Company of Iran (TCI) for the acquisition of 9 gateway hubs and 300 demand assigned multiple access earth stations using the TDMA technique, all in the 14/11 GHz band.

23. This expansion is intended for use to improve rural and remote area communications and also to satisfy the need for applications such as data transfer, multi-point-to-point, point-to-point, short-term and emergency communication services and Internet links. TCI believes that satellite communication is a suitable solution for the rural points that are far from terrestrial links or are facing barriers or technical problems. In this regard, TCI is planning to provide communication service for 2,000 rural points and 500 private users with satellite communications systems in the near future.

24. In addition, TCI is considering plans to provide telemedicine and tele-education services to points without quick access to central hospitals and universities.

25. There are presently three Internet service providers in the country, each with a satellite link to the WIT site in Washington, through Europe.

26. During the last year, TCI has also announced a tender for the construction and launch of two Ku-band geostationary orbit satellites, to be placed at 34° E and 47° E. The satellites are named "Zohreh" and are intended to take over the domestic traffic presently handled by the INTELSAT satellite.

27. The Islamic Republic of Iran has only one Inmarsat Coast Earth Station near Tehran, which provides services to a fleet of ship- and land-portable terminals of standards A and C. TCI has also recently signed an agreement with the ICO organization, an offspring of Inmarsat, to invest and provide mobile satellite service in the region. Studies are also ongoing to investigate the possibilities of joining various big LEO systems such as Globalstar and future Global Mobile Personal Communications by Satellite (GMPCS) networks.

28. The Islamic Republic of Iran Broadcasting Organization (IRIB) has implemented many expansion projects making effective use of three 72 MHz Ku-band transponders on the 63° E INTELSAT satellite. Four national television channels are now broadcast nationwide, making use of 2,600 television receive only (TVRO) terminals, thus rendering almost complete national television coverage.

29. IRIB has also recently launched a Ku-band television broadcast over Europe and the Middle East via the EUTELSAT satellite. In addition, IRIB owns two C-band Earth stations relaying news items to Asiavision and also internationally through INTELSAT. Two transportable Earth stations are also available for satellite

news gathering transmission from any point around the country and neighbouring countries.

30. IRIB owns 31 VSAT earth stations for its private communication purposes. IRIB is also now making extensive studies for the transformation from analogue sound and television to digital transmission via satellite.

31. IRIB has already been using different facilities in order to broadcast and receive internal and external programmes. These activities include the use of INTELSAT, EUTELSAT, HOTBIRD-3 and TELESTAR-5 satellites through the utilization of four fixed stations and three portable satellite news gathering stations.

7. Space science and technology

32. As a member of the Asia-Pacific Multilateral Cooperation in Space Technology and Applications, the Islamic Republic of Iran is one of the seven countries, in addition to Bangladesh, China, Mongolia, Pakistan, the Republic of Korea and Thailand that have agreed to participate in manufacturing and launching of a small multi-mission satellite. The project is continuing with good cooperation and understanding between the main partners, China, the Islamic Republic of Iran and Thailand.

33. Another initiative is that of the Ministry of Science, Research and Technology, in cooperation with the Ministry of Post, Telegraph and Telephone, to foster educational and technological development and take fundamental steps towards space technology, especially in the field of satellite design and manufacturing. To meet this goal, a small research project entitled "MESBAH" was defined for design and development purposes as a micro-satellite to be placed in LEO. The main task of this project is to train Iranian specialists and to support Iranian research centres and universities with satellite manufacturing technologies. Objectives of this project include: (a) designing and developing a micro-satellite in amateur radio frequency bands, to be deployed to LEO with the aim of research, e-mail and store-and-forward data communication; (b) scientific research work and training tasks to gain experience in and possibilities for developing communication satellite systems of the store-and-forward type.

34. Technological goals involved in these areas include the establishment of hardware, definition of steps required for space research, improvement of domestic industries for space activities and familiarization with remote sensing, Earth observation and related technologies.

35. Exploration of the outer atmosphere is another basic activity of space-related sciences within the country. In this regard, the Intelligent Systems Research Institute (ISRI) plans to develop a variety of sounding rockets of low-, medium- and high-altitude capability. The ionosphere, upper atmospheric winds, micro-gravity, atmospheric composition and atmospheric structure (including pressure and density) are topics selected for further investigation to meet the objectives defined above.

36. In this respect, the industries in the Islamic Republic of Iran have also been encouraged to implement technological development plans for aerospace-related technologies and subsystems that can be applied to space systems as well.

37. Another active organization in space science and technology applications is the Aerospace Research Institute (ARI), affiliated to the Ministry of Science,

Research and Technology, which follows different space studies and activities. The Aerodynamic Group of ARI concentrates presently on the aerodynamic design and analysis of launch vehicles. The Group is capable of estimating the aerodynamic coefficients and determining flow patterns around launch vehicles with various levels of accuracy required in different phases of the design process. Planning and conducting wind tunnel tests for validation of analytical and numerical results is also among the capabilities of the Group. The Sounding Rocket Group works on sub-orbital rockets called "sounding rockets" and their payloads. It has carried out several studies in the field of sounding rocket capabilities and applications, their payloads, the experiments conducted by them, and other related subjects. The group is capable of planning sounding rocket experiments, as well as selecting and/or designing the required payload and equipment.

38. Due to the effects of humankind's aerospace activities on the environmental health of the Earth, space debris has emerged in recent decades as a problem seriously threatening to the survival of orbiting spacecraft, space platforms and astronauts carrying out space walks in near-Earth orbit. In this regard, the orbital debris team of ARI, as a part of the Space Standards and Law Research Group, is working on a variety of subjects such as categorization, characteristics, tracking and laws of orbital debris. Mathematical simulation and collision probability functions and hazard analysis are prospective topics for the group's studies.

39. The Galactic Dynamics and Celestial Mechanics Group is a part of the Space Science and Technology Group, which prepares dynamic models of galaxies and models quantitatively and qualitatively. The data and solutions are then compared with observational information for validation purposes.

8. International and regional cooperation

40. Aiming to present its willingness for worldwide and regional collaboration and to fulfil its obligations to international and regional bodies, the Islamic Republic of Iran not only acts as a member of several international agencies, such as the International Telecommunication Union (ITU), the World Meteorological Organization (WMO), the Food and Agriculture Organization of the United Nations (FAO) and other United Nations affiliated bodies and programmes, but also has a very close relationship with the Regional Space Applications Programme for Sustainable Development (RESAP) of ESCAP. In addition to these activities, the Islamic Republic of Iran is an active member of the Asia-Pacific Multilateral Cooperation in Space Technology and Applications and many other regional and international societies, institutions and projects.

41. The Islamic Republic of Iran also emphasizes its willingness to join the network of Centres for Space Science and Technology Education in Asia and the Pacific and establish a similar node for the country.

42. Furthermore, the Islamic Republic of Iran is participating in the different working groups that are being organized following the recommendations of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III).

Japan

[Original: English]

1. Introduction

1. Japanese space development has mainly been promoted by three space organizations, which are the National Space Development Agency of Japan (NASDA), the Institute of Space and Astronautical Science (ISAS) and the National Aeronautical Laboratory (NAL). NASDA has conducted space development and utilization of outer space under the supervision of the Ministry of Education, Culture, Sports, Science and Technology (MEXT), the Ministry of Public Management, Home Affairs, Posts and Telecommunications (MPHPT) and the Ministry of Land, Infrastructure and Transport (MLIT). ISAS, which is an affiliated national institute of MEXT, has promoted research on space science. NAL, which is an Independent Administrative Institution supervised by MEXT, has pursued research on aircraft, rockets, and other aeronautical transportation systems.

2. Integration of space organizations

2. MEXT announced a plan to integrate NASDA, ISAS and NAL on 21 August 2001. MEXT has started discussions on the structure of a new space agency in a committee, chaired by Takashi Aoyama, Senior Vice Minister of MEXT, which plans to reach its conclusions by the end of March 2002.

3. Major space activities in 2001

(a) Launch vehicles

(i) H-IIA

3. On 29 August 2001, NASDA successfully launched a new launch vehicle called H-IIA, a successor of H-II. The inaugural flight was made following developmental activities from 1996, the conceptual study having started in 1993. H-IIA's standard configuration consists of an approximately 53-metre-long, two-staged main body and two solid rocket boosters. It can deliver 4- and 10-ton payloads to the geostationary transfer orbit (GTO) and LEO, respectively. The design flexibility of H-IIA allows the launcher to accommodate more boosters attached to the first stage. With this augmentation, H-IIA can carry up to 9.5- and 23-ton payloads to GTO and LEO, respectively. Compared to its predecessor (H-II), H-IIA has greater launch capability and aims to achieve higher reliability and lower launch costs. More H-IIA flights are scheduled in and after 2002. H-IIA carries, among others, observation satellites including ADEOS-II and ALOS, which are expected to contribute to understanding global climate change and monitoring natural disasters.

(ii) M-V

4. ISAS has developed the M-V launch vehicle, which has the world's largest solid propellant satellite launch system, newly developed lightweight materials and structures, flight control and guidance, aerodynamics, and avionics, among other things. In 2001, ground-firing and the vacuum-firing tests for M-V-5, which is scheduled to be launched at the end of 2002, were conducted successfully. As M-V-

5 will be the first launch after the failure of the M-V-4 in February 2000, a series of tests are being carried out continuously to ensure the success of its launch.

(iii) Research on reusable launch systems

5. ISAS has conducted studies on fully reusable launch systems for future space transportation. In June 2001, the second series of flight tests of the reusable rocket vehicle was completed after three successive flights to demonstrate vertical landing, repeated flights and turnaround operations of the liquid-hydrogen-propelled rocket vehicle. The test results provided useful data for the next step: the development of a reusable launch vehicle.

(b) International Space Station

6. Japan is participating in the International Space Station programme with the Japanese Experiment Module "Kibo", together with a transportation system called the "HTV" (H-II Transfer Vehicle), and "Centrifuge". All the flight components of Kibo are now gathered at NASDA Tsukuba Space Center (TKSC), and the overall Kibo system test started in October 2001. As Kibo is scheduled for launch in 2004-2005, NASDA is now establishing a Mission Control Center at NASDA TKSC to prepare for 24-hour real-time operation. Meanwhile, various Japanese experiments have already been conducted at the International Space Station. The first experiment, using the Bonner Ball Neutron Detector (BBND), was implemented in March 2001. The Micro-Particle Capture apparatus, the Space Environment Exposure Device and the High-Definition Television Camera System were carried to the Space Station in July 2001, and experiments are now being conducted there.

(c) Space science satellites

(i) YOHKOH

7. YOHKOH has made valuable contributions to better understanding of the dynamic solar atmosphere since its launch on 30 August 1991. The quality, coverage and duration of YOHKOH data are unprecedented in a solar space mission. An international symposium, the "YOHKOH 10th Anniversary Meeting", will be held in January 2002, and a number of scientists from all over the world have been invited to celebrate YOHKOH's successful operation.

(ii) Advanced Satellite for Cosmology and Astrophysics)

8. The X-ray astronomy Advanced Satellite for Cosmology and Astrophysics (ASCA) re-entered the atmosphere and disappeared on 2 March 2001. Since its launch in February 1993, it performed scientific observations for about eight years and logged numerous world-famous X-ray astronomy results, including providing evidence for extra-galactic massive stellar black holes.

(d) Hosting international conferences

(i) Committee on Earth Observation Satellites/Integrated Global Observing Strategy Partnership

9. In 2001, MEXT and the NASDA co-chaired the Committee on Earth Observation Satellites (CEOS), and NASDA also served as the Chair of the Integrated Global Observing Strategy Partnership (IGOS-P). Established in 1984, CEOS now has 22 members and 19 associates. CEOS has the primary objective of optimizing the benefits of space-borne Earth observations through cooperation of its members by international harmonization of their space programmes and is now actively working with IGOS-P to address global environmental data needs. This cooperation is realized through "IGOS themes" in fields such as the ocean, carbon cycle, atmospheric chemistry, disaster mitigation, water cycle, coral reefs and others. The top priorities of NASDA, as the chairs of CEOS and IGOS-P during 2001 were:

(a) To reinforce the structure and technical progress of the IGOS themes, especially the ongoing oceans and carbon themes (the latter being a response to the Kyoto Protocol), and the emerging theme entitled "water cycle coordinated enhanced observation period";

(b) To strengthen contributions by IGOS partners to environmental conventions in order to secure essential support from the international community;

(c) To encourage and support CEOS working group activities, particularly to help realize the transfer of their accomplishments to CEOS plenary and IGOS partners through specific application projects.

10. Many Earth observation satellites will be launched in the coming years. With the staging of the World Summit on Sustainable Development in 2002 as a forum for expressing global priorities for environmental issues and data needs, it is particularly timely for CEOS to intensify its efforts, along with various international partner organizations, to work together to tackle these priorities. The fifteenth CEOS plenary and eighth IGOS-P meeting were held in Kyoto, Japan, in November 2001, with such issues at the top of the agenda.

(ii) Asia Pacific Regional Space Agency Forum

11. The Asia Pacific Regional Space Agency Forum (APRSAF) was established on the occasion of the International Space Year in 1992. Its main purposes are to exchange information on national and regional space activities, to discuss possibilities of cooperation among developers and users of space technology, and to review the progress of implementation of cooperative activities. The eighth session of APRSAF was held in Malaysia from 23 to 26 July 2001, hosted by MEXT, ISAS and NASDA in cooperation with the Ministry of Science, Technology and Environment (MOSTE) of Malaysia and the Malaysian Centre for Remote Sensing (MACRES). Approximately 100 people from 23 countries participated. Sessions were held on Earth observation, satellite communication applications, education and awareness, and space environment utilization, and recommendations were made on:

(a) Promoting natural and environmental disaster mitigation satellite communication pilot projects;

(b) Promoting easy access to information related to utilization of the International Space Station;

(c) Effectively utilizing programmes for capacity building and exchange of educational materials;

(d) Establishing a web site to facilitate the above three actions.

Panama

[Original: Spanish]

1. The National Air Service has at present no national space activities to report and is not carrying out any investigation or study on the safety of space objects with nuclear power sources on board or any national investigation on space debris, its impact and ways of protecting space objects from this danger.

2. Within the System of Cooperation among the American Air Forces (SICOFAA), the National Air Service is not a member of the Committee for Science and Technology, a forum in which valuable information and experience on aeronautical and space matters that could well be useful to Panama are exchanged.

3. It is evident that the economic situation and level of training in Panama precludes its active involvement in any way in these aerospace developments. The National Air Service nevertheless has the responsibility of keeping abreast of such developments in order to identify both opportunities for discharging its institutional responsibilities more effectively and also any threats to national security that might arise. Such opportunities would be the application of advances in satellites to search and rescue operations or aeronautical communications, while the threats are the proliferation of space debris that could in some way represent a risk to public health or security or endanger the country's infrastructure.

Peru

[Original: Spanish]

1. Introduction

1. The development of space activities in 2001 has been affected by a change of government and the implementation of very difficult austerity policies that have affected all state institutions, particularly those engaged in scientific and technological activities.

2. The cutbacks have been unprecedented, and goals have necessarily had to be scaled down; as a result, the five-year plans for 2002-2006 are no longer valid. The establishment of a Ministry of Science and Technology to implement a sectoral policy for all government institutions involved in science and technology is a matter of utmost importance since, if such a ministry is not established, development goals will remain extremely limited and Peru's technological development will continue to lag behind that of the rest of the countries of the region.

3. Space activities are an aspect of technology that is little understood by decision makers and have been the most affected by the cutbacks, since they require

vast resources. One of the main reasons for decision makers' reluctance to earmark resources for such activities is that the impact of space technology on short-term development goals cannot be measured with any degree of certainty.

2. Astronomy

4. The Main National University of San Marcos, through the Department of Physics and the School of Astronomy, has set up an astronomical observatory in the Marangani region in Cuzco department, for the observation of variable binary stars.

5. The Geophysical Institute of Peru, in coordination with the National University of Ica and the Department of Sciences, set up a small telescope equipped with a CCD camera for the observation of sunspots, and also plans to establish a new astronomical observatory in the desert of Ica department. The observatory will contain two telescopes donated by Japan, which have yet to be installed.

6. Researchers of the National Aerospace Research and Development Commission (CONIDA) won a national competition sponsored by the National Science and Technology Council for the financing of research projects on variability of cumulus clouds; the award will help them to install a new CCD camera for the telescope of the Marangani observatory.

7. The same group of researchers, together with students of the physics department of the Main National University of San Marcos, are engaged in research on sunspots using CONIDA facilities. They are also cataloguing such information as well as permanent measurements of variation in the magnetic field in three axes. These data have enabled CONIDA to forecast radio wave propagation, information which is made available to users.

3. Activity in the ionosphere

8. The Jicamarca Radio Observatory of the Geophysical Institute of Peru continued its measurements of ionospheric and equatorial phenomena, such as the equatorial electro-jet, spread-F and sporadic-E, as well as measurements of winds and electric charge, as contributions to the international radio science community.

9. At the same time as the aforementioned measurements, and in the context of the Antarctica programme, measurements were made from the Macchu Pichu station at which a small mass store system (MSS) radar device was installed, and occasionally correlated with measurements made using the same equipment at the campus of the University of Piura in northern Peru.

4. Satellite activity

10. The CONIDASAT-01 project continued to implement its goals for the year 2001, culminating in the construction of a clean room class 100, which will make it possible to align the CCD camera that is a component of the instrument on board the mini-satellite. The construction of the instrument has been completed and the process of installation and adjustment of the instrument, as well as the devices for deploying the solar panels, is in the testing stage. The various modules are still in the design or construction stage; a great deal of assistance is being provided by local engineers and industry.

11. The participation of two specialists from the Aviation and Space Agency of the Russian Federation in the capacity of advisers has made it possible to conduct a mid-term analysis of the project in order to maintain project quality and find mechanisms to ensure its completion and launch into outer space.

5. Space telecommunications

12. The expansion of local communications, the Internet and commercial traffic has increased the number of companies that provide telephony and television service, through new HUB or VSAT systems, to meet small-scale requirements.

13. The use of satellite telephones has facilitated operations within the country, particularly for Peru's large mining industry, which can afford the higher costs of this service. Thus, satellite telephone service competes with conventional services.

6. Satellite tracking

14. A policy developed by the Ministry of Fisheries for the monitoring of large fishing vessels has been implemented in Peru through the use of the Argos system. New technologies, such as the ORBCOMM system, are also being used to track vessels and cargo trucks. The system has enabled oil wells to send information in the form of electronic mail to operations centres.

15. New companies have created systems to monitor armoured vehicles transporting money and valuables and have established sophisticated units that use GPS. The same system has been used by special metropolitan police units to track and position their units.

7. Training

16. The CONIDA Centre for Space Studies continued its training programme, giving monthly courses on remote sensing technology through the use of satellite information, GIS and GPS, with 1,350 degree candidates in the four years since it began its activities.

17. Under a training programme organized by the Centre in conjunction with the National University of Engineering, and with the participation of professors from universities of the Russian Federation, the first group of specialists have received master's degrees in unmanned vehicles, thus fulfilling the Centre's planned objective. A study is being conducted to make way for a larger and more ambitious programme to be carried out directly between the CONIDA Centre for Space Studies and the Moscow State Aviation Technology Institute of the Russian Federation. This programme will also meet the needs of students in the Latin American region by offering master's degrees and doctorates in such subjects as astronomy, remote sensing, propulsion, lasers and so on.

18. As part of the preparations for the next master's degree programme, courses in the Russian language have begun. This will enable the professional staff of CONIDA to gain a limited reading, writing and speaking knowledge of Russian in anticipation of forthcoming courses, since master's degrees and doctorates will be obtained in Moscow. The Centre for Space Studies, in cooperation with the Language Centre of the Embassy of the Russian Federation, has agreed to conduct an ongoing Russian language programme at CONIDA facilities.

8. Events

19. In accordance with planned activities, in October 2001 the National Symposium on Space Science and Technology was held in the CONIDA auditorium. The participation of 32 university professors from many other provincial universities was made possible by support from the National Council of Science and Technology.

20. A varied programme of conferences and exhibitions on the applications of space science and technology filled the auditorium to capacity. The event was supplemented by a major photographic and philatelic exhibition and the showing of unedited videos to commemorate the launching into space of the Russian cosmonaut Yuri Gagarin.

Republic of Korea

[Original: English]

1. Introduction

1. The space programme of the Republic of Korea comprises space communications, satellite development and Earth observation. The key research areas in space applications, other than space communications, are satellite remote sensing, GIS and GPS. Current research activities are undertaken by various organizations, including research institutes and universities. At the national level, the Ministry of Science and Technology, the Ministry of Commerce, Industry and Energy and the Ministry of Information and Communication play important roles in coordinating and implementing space technology policy as well as in funding space development research. At the local level, local governments conduct research based on satellite information for the development of their communities in the areas of environment, water resources, forests, fisheries and industry.

2. Each and every country may have its own reasons for developing space technology. The Republic of Korea, like other peaceful countries, has national necessities for space development. Under the topic "Space is the new realm to challenge", it is understood that:

(a) Space technology is a core to drive other high-tech industries in the twenty-first century;

(b) The commercial uses of space technology will expand;

(c) Space technology is a core for technological independence.

3. The Republic of Korea established the first National Space Program in 1996 and modified it in 2000. The Government established the objectives of space development as follows:

(a) Achievement of indigenous capability to launch scientific satellites by 2005;

(b) Indigenous development and launch of a LEO multi-purpose satellite by 2010;

(c) Entering into the top 10 countries worldwide in the space industry by 2015.

4. As strategies, the Government should implement the comprehensive coordination of research and development in space technology and build strong linkages between companies, universities and research institutes. To achieve comprehensive coordination of research and development in space technology, it should strengthen policy coordination through an Expert Committee on Space Development under the National Science and Technology Council. In order to build strong linkages between companies, universities and research institutes, the Republic of Korea will designate the Korean Aerospace Research Institute (KARI) as a centre of national space development and conduct joint research between companies, universities and research institutes in the implementation of space development programmes, such as joint research on the development of space and launch vehicles and on the application of satellites.

5. The recent, unexpected economic difficulties could have created minor setbacks for the national space programme but, in general, the space programme is marching forward under the revised framework of the Korean Space Program, approved by the Council headed by the President in 2000.

2. Space programme

6. The twenty-first century is the so-called "era of space". According to the Korean Space Program, the ultimate goal is to become one of the world's top 10 countries by 2015. For this, 20 satellites are planned for development by the year 2015, comprising 8 multi-purpose satellites, 7 scientific satellites, and 5 geostationary-orbit satellites. In order to accomplish this, the country should build up indigenous capability to develop LEO multi-purpose satellites and acquire the capability of satellite data processing and application technology.

(a) KOMPSAT Programme

7. KARI has been developing the Korea Multi-purpose Satellite-1 (KOMPSAT-1, or Arirang), a small 510-kg Earth observation satellite with an orbital altitude of 685 km, for five years, jointly with TRW Inc. of the United States. On 20 December 1999, KOMPSAT-1 was successfully launched from the Vandenberg Air Force Base, California, United States.

8. KOMPSAT-1 has three mission payloads: a high-resolution electro-optical camera (EOC), an ocean scanning multi-spectral imager (OSMI) and a space physics sensor (SPS). As a main mission payload, the EOC collects panchromatic imagery with a ground sample distance (GSD) of 6.6 metres and a swath width of 17 km by pushbroom scanning. Using the roll-tilt capability of KOMPSAT-1, the EOC can take stereo images that enable the production of a digital elevation model. The KOMPSAT-1 EOC imagery could be used as basic information material for GIS and land development programmes. The primary mission of OSMI is to conduct worldwide ocean colour monitoring and environmental monitoring. It will generate 6-band ocean colour images with an 800-km swath and 1-km GSD by whiskbroom scanning. OSMI is designed to provide on-orbit spectral band selectivity in a spectral range from 400-900 nanometres through ground command. SPS consists of a high-energy particle detector (HEPD) and an ionosphere measurement sensor

(IMS). The HEPD mission is to characterize the low-altitude high-energy particle environment. IMS measures densities and temperatures of electrons in the ionosphere. The Republic of Korea started releasing its data for local and overseas users on 1 June 2000, enabling the data to be used for peaceful purposes.

9. Following the successful launch of the KOMPSAT-1, KARI is now developing the Korea multi-purpose satellite-2 (KOMPSAT-2), a 700-kg Earth observation satellite with an orbital altitude of 500-800 km. Its orbit will be similar to that of KOMPSAT-1. The main mission of KOMPSAT-2 is GIS image acquisition for the Korean region. A multi-spectral camera (MSC) will be the main payload of KOMPSAT-2 and is now being developed jointly with Elbit System Ltd. in Israel. MSC will be capable of taking photostatic images with 1-m panchromatic visible resolution and 4-m multi-spectral resolution.

(b) KAISTSAT-4 Programme

10. The fourth small satellite of the Republic of Korea, KAISTSAT-4, is being developed by the Satellite Technology Research Center of the Korea Advanced Institute of Science and Technology (KAIST). The KAISTSAT-4 programme commenced in October 1998 and will be completed in mid-2002.

11. KAISTSAT-4 has been assigned to several missions for applications of space science and technology. It carries payloads for various space science observation and space engineering tests. The aim of its space science missions is to investigate the evolution and spatial distribution of hot interstellar medium by performing spectral diagnostics in the far ultraviolet range. Also, the space physics of the Earth's polar region will be studied by simultaneously measuring the populations of charged particles precipitating into the Earth's upper atmosphere. KAISTSAT-4 will deploy a satellite-based data collection system (DCS) to carry out environment monitoring, wildlife tracking and transportation monitoring. DCS is being developed jointly through international cooperation with Australia. One of the main missions of KAISTSAT-4 is the development and in-orbit testing of a precision star sensor necessary for precise attitude control, which is essential for high-resolution Earth and space observation.

(c) KOREASAT Programme

12. A new broadcasting law, the Integrated Broadcasting Act, was passed at the end of 1999 by the National Assembly of the Republic of Korea and commercial satellite broadcasting service commenced in the Republic of Korea under the Act. The Republic of Korea will have high-quality television, telecommunications and Internet service lines using communication satellites. The new Act encourages many companies to participate in the satellite-based Internet service business. As the demand for transponders increases, KOREASAT-2 and -3 will play a key role in the future market.

13. In addition to the KOREASAT Programme, the Republic of Korea has carried out research on the prospects of the domestic satellite communication market and has conducted a feasibility study on the local development of communication satellites. According to the study, the need for satellite transponders is expected to increase at an average yearly growth of four per cent, based on surging Internet usage. In 2000, research institutes and industries in the Republic of Korea began to

develop transponders for communication satellites, which are intended for use on the next satellite of the Republic of Korea.

(d) Launchers

14. KARI embarked on a research and development programme for the science and observation rocket Korea Sounding Rocket-I (KSR-I) in 1990; it was the first domestic single-stage unguided solid-propellant scientific rocket, with a length of 6.7 metres, a diameter of 0.42 metres and lift-off weight of 1.2 tons. In order to measure the vertical ozone distribution in the stratosphere over the Korean Peninsula, KSR-I rockets were launched on 4 June and 1 September 1993, each carrying an ultraviolet radiometer. Temperature, acceleration and other parameters were also measured to examine the performance of the rocket through the test flights.

15. KSR-II was a two-stage solid-propellant scientific rocket developed for scientific experiments in the upper atmosphere. Based on the experience acquired through the development and launch of single-stage rockets, KARI was able to build the KSR-II. The rocket has a length of 11.04 metres, a diameter of 0.42 metres and a total weight of 2 tons. It measured the vertical distribution of ozone using an ultraviolet radiometer. It also measured ionosphere electron density and temperature using a Langmuir probe. In addition, astronomical observation experiments using an X-ray proportion counter were conducted. The Republic of Korea is going to build a capability for launching scientific satellites indigenously by 2005 and to indigenously develop a LEO multi-purpose satellite and launcher by 2010.

(e) Space Center

16. A Space Center will be constructed for the space launcher. The first stage of construction of the Space Center will be finished in 2005, for launching LEO scientific satellites. The Center is located at KO-Hoeung, on the southern coast of the Korean Peninsula.

(f) The Committee on the Peaceful Uses of Outer Space

17. The Republic of Korea participates in sessions of the Committee on the Peaceful Uses of Outer Space. In addition, the Republic of Korea became a member of two action teams on the implementation of recommendations of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III): recommendation 10, on improving universal access to and compatibility of space-based navigation and positioning systems; and recommendation 13, protecting the near-Earth space and outer space environments through mitigation of space debris.

3. Space technology applications and space science

(a) Space technology applications

18. KOMPSAT-1 has been enhancing the remote sensing sector in the Republic of Korea by carrying out the following research and utilization activities:

(a) Formulating data policy for KOMPSAT-1 data users consisting of:

(i) Basic plans of data application;

(ii) KOMPSAT-1 operation plan;

(iii) Methods of data distribution to public and commercial users;

(iv) Pricing policy etc.;

(b) Forming KOMPSAT-1 data user groups by:

(i) Establishing a data distribution system;

(ii) Holding a KOMPSAT-1 workshop for users;

(iii) Contracting with a marketing agency, the Korea Aerospace Industry Ltd. (KAI), to target commercial and overseas users;

(c) Interfacing between the users and KARI by making available:

(i) A web site application for KOMPSAT-1 users (see http://kompsat.kari.re.kr and http://kgs.kari.re.kr;

(ii) Offices and software system for external users.

19. The policy on data requires a basic strategy on KOMPSAT-1 data application. Its basic objectives are to maximize the use of KOMPSAT-1 data and stimulate a balanced development of public, academic and commercial applications.

20. Domestic user groups can utilize KOMPSAT-1 data for non-commercial public and research purposes. User groups have to register the name of their organizations when using KOMPSAT-1 data. Commercial and overseas users can purchase KOMPSAT-1 data from KAI, the marketing agency of KOMPSAT-1 data. KAI receives KOMPSAT-1 data from KARI and sells the data to domestic commercial and private users as well as to overseas users. Some 79 government organizations, public organizations, institutions and universities have now registered to use KOMPSAT-1 data for public and research use.

21. An investigation was carried out to look into users' fields of data application during an eight-month period of testing and regular distribution. Users utilize KOMPSAT-1 data in various fields, based on the payloads. The following table summarizes the users' fields of application. EOC has been applied for land cover classification and cartography, while OSMI has been utilized for calibration/validation of data, atmospheric correction and oceanography.

User's fields of application based on payload

Payload	*Data application fields*
EOC	Remote sensing, including cartography, analysis of topography, national territory utilization and management, coastal management, disaster monitoring and prevention, environmental monitoring, ocean monitoring, geographical and Earth physics, agriculture and forestry, development of water resources, development of land and software development

Payload	*Data application fields*
OSMI	Remote sensing, including environmental monitoring, coast and harbour management, ocean current research, vegetation research, development of natural resources, meteorology, and software development
SPS	Research on the ionosphere and the space environment, estimation of random access memory performance and other applications

22. Although, in general, KARI distributes stored EOC, OSMI and SPS data, it collects and distributes KOMPSAT-1 data with top-level priority in the case of a national security emergency or disaster. During the normal operation of KOMPSAT-1, registered users can acquire KOMPSAT-1 data through the regular procedure.

23. The KOMPSAT Receiving and Processing Station (KRPS) has an online data catalogue search system for KOMPSAT-1 data. Every user of KOMPSAT-1 data can search EOC and OSMI data via the Internet. The catalogue database is maintained by the external browse module (EBM) server including browsable EOC and OSMI images and related information such as date, time, geographical location, cloud cover and so on. KARI also provides an online service for KOMPSAT-1 SPS data. Registered users can acquire SPS data for scientific research and use the file transfer protocol (FTP) system.

24. KARI is trying to provide a user-friendly interface system using the World Wide Web and an active server page (ASP), which can be operated simply with the click of a mouse.

(b) Space science

25. Korean people have a long tradition of celestial observation and study of the origins of natural phenomena, which have been observed by astronomical observatories since the fifth century, AD. While it is difficult for most Korean people to understand benefits of basic science, because of its short history, many scientists working in the space-related field in the Republic of Korea are trying to continue their tradition and to participate in global efforts for the peaceful use of space. Space science research in the Republic of Korea has been carried out by KARI, Korea Astronomy Observatory (KAO), the KAIST Satellite Technology Research Centre, and major universities.

26. As satellite and sounding rocket programmes evolved in the 1990s, space science research also became more active in the Republic of Korea. Analysis of data from foreign programmes or ground-based observations constitutes the major portion of space science research in the Republic of Korea. The KAISTSAT series has measured global high-energy particle distribution and the Earth's magnetic fields. KOMPSAT-I carries out global ionospheric measurements as well as high-energy particle experiments. Sounding rocket programmes have also contributed to ionospheric and ozone-layer experiments. Other experiments in ultraviolet and X-ray observation are also growing subjects for upper atmospheric science and astronomy using satellites and sounding rockets.

27. Scientists from the Republic of Korea are now involved in NASA research programmes, aimed at international collaboration in space science and applications. One example is participation in the Advanced Cosmic-ray Composition Experiment

(ACCESS) on board the International Space Station. Through the joint development of supporting modules for the International Space Station payload and the acquisition of related technology, the Republic of Korea will become active in the international exchange of technology and intensify its international cooperation.

Syrian Arab Republic

[Original: Arabic]

The Syrian Arab Republic endorses the Vienna Declaration on Space and Human Development of UNISPACE III. Furthermore, the Syrian Arab Republic participates in most United Nations activities on the peaceful uses of outer space and is a member of several committees emanating from those activities.

Turkey

[Original: English]

1. The Information Technologies and Electronics Research Institute (BILTEN) is a research institute of the Scientific and Technical Research Council of Turkey (TUBITAK), located at the Middle East Technical University Campus in Ankara. Space activities at BILTEN in 2001 can be grouped into two categories: the small satellite project; and GIS activities. These activities are described in detail below.

1. Small satellite project

2. The small satellite project is being carried out by the Satellite Technologies Group of BILTEN. The main purpose of the project is to acquire the necessary knowledge and expertise in manufacturing small satellites at BILTEN, whereby BILTEN will become the first satellite manufacturer in Turkey. In other words, it is a technology transfer project. The work to realize the project started in 1997 with permission from the State Planning Office of Turkey to obtain an international loan to finance the project. Tender documents were prepared, and a number of companies from different countries were invited to bid for the project.

3. The proposals were carefully evaluated. Surrey Satellite Technologies Ltd. (SSTL) of the United Kingdom was selected, and a contract was signed in February 2000. After a lengthy process, the financing became available in the first half of 2001, and a kick-off date of August 2001 was set.

4. In this project, a small Earth observation satellite will be designed and manufactured at the premises of SSTL, together with BILTEN engineers. In this way, it is expected that BILTEN engineers will gain the necessary experience and knowledge to design, manufacture and test small satellites as well as to conduct launch campaigns. The satellite will carry five Earth observation cameras. The first will be a panchromatic camera with a ground-sampling distance of 12 metres at an altitude of 650 km (coverage: 25 km x 25 km). The remaining four cameras will obtain images in the red, green, blue and near-infrared bands with a ground-sampling distance of 26 metres at an altitude of 650 km (coverage: 50 km x 50 km). The satellite will have very accurate pointing and will be capable of imaging the

same area at different angles of incidence, permitting the virtual construction of stereoscopic images. The satellite is expected to be operational in orbit in mid-2003.

5. In addition to the small satellite, a satellite-control ground station will also be constructed on BILTEN premises. The ground station will be capable of receiving satellite data in S-band (8 Mbit/s) and UHF bands. It will transmit telecommand signals in S-band and VHF bands.

6. For future small satellite projects, a test and integration laboratory (United Kingdom Class H) will also be furnished at BILTEN within the framework of the project. The laboratory will be located at the new BILTEN building; the construction of the building began in June 2001 and is expected to be completed in December 2001.

7. Since kick-off, BILTEN engineers have been given a short course at SSTL and started working on the satellite design. The mission design review has been successfully completed, and a preliminary design review will be conducted in December 2001.

2. Geographic information systems

8. Another area of space activity at BILTEN, carried out by the Signal Processing and Remote Sensing Group, involves geographic information systems. BILTEN has primary data user station receivers for METEOSAT satellites and high-resolution picture transmission receivers for NOAA satellites, obtained in 1996 through the TU-REMOSENS project, supported by the North Atlantic Treaty Organization (NATO). The Group continued to receive and archive the satellite images in 2001. These images are used for various remote sensing purposes, and images from the archive are also disseminated to interested parties.

9. Images are provided in real time from the following Internet sites:

http://noaa.bilten.metu.edu.tr

http://meteosat.bilten.metu.edu.tr

METEOSAT images are presented as raw images in three bands (visible, infrared, water vapour) and also as projected, colourful images for Turkey.

10. Currently, up to 15 images per day are received from NOAA-12, -14, -15 and -16 for the Turkish territory. These images are passed to the Internet site as quick-look images in reduced resolution. The actual images received are archived after proper compression.

Ukraine

[Original: Russian]

1. Space activities in Ukraine in the year 2000 were directed at meeting the country's obligations under international programmes and projects, implementing the priority projects of the national space programme for 1998 to 2002, improving the effectiveness of the work of the national space sector through restructuring and marketing, introducing advanced space technologies to an increasing extent, enhancing competitiveness and the conditions for private initiative, and

collaborating with international financial, scientific, technological and other organizations on a large scale.

2. The following activities were carried out to further the priority projects within the national space programme for 1998 to 2002.

1. Development of space technologies

(a) Space telecommunications systems

3. A satellite network for data transmission by television and radio throughout Ukraine and for transmission of Ukrainian television programmes abroad was completed and trial operation commenced.

(b) Satellite radio-navigation system

4. Work continued on setting up a satellite navigational timekeeping system in Ukraine.

(c) Remote sensing

5. Remote sensing of the Earth is one of the main thrusts of Ukraine's space activities. Under the aegis of the National Space Agency of Ukraine (NSAU), a multipurpose Earth observation system is being set up using the Sich-1 and Okean-O artificial satellites and data from Meteosat, NOAA, ERS, Landsat, IRS and other satellites.

6. Among the main areas of exploitation envisaged for the Sich remote sensing system are the reception, processing and use of information for scientific and commercial purposes, the development of advanced Earth observation technologies and technical facilities, and the offering of information on foreign markets. Data from the Okean-O, Meteosat and NOAA satellites has been used since 2000 by the State Hydrometeorology Department to forecast, give warning of and respond to natural disasters (hurricanes, storms, floods etc.); by the Ministry of Emergency Situations to assess and deal with the consequences of natural disasters, notably in the Chernobyl region, which is affected by floods and forest fires; and by the Ministry of the Environment in collaboration with NSAU and the National Academy of Science of Ukraine to monitor pollution of surface waters, particularly along the Dniepr reservoir cascade.

(d) Terrestrial information and communications centres

7. The National Space Technology Operating and Test Centre carried out the following tasks last year:

(a) Operation of satellites in accordance with international, intergovernmental and national space programmes;

(b) Space research using national terrestrial space facilities;

(c) Reception of specialized data from satellites;

(d) Monitoring of State navigational activities;

(e) Monitoring and analysis of conditions in space.

8. These activities are currently being carried out by the following centres within the National Space Technology Operating and Test Centre: the Centre for Satellite Flight Control; the Centre for the Reception of Scientific Information; the Centre for the Reception and Processing of Specialized Data and Monitoring of Navigational Activities; and the Centre for Space Monitoring.

2. Space research

(a) Research on near-Earth space and the Earth from space

9. A number of projects (Ionosphere-1, Ionosphere-2, Ionosphere Variant) are devoted to designing facilities and software for the investigation of acoustic communications channels in lithospheric-ionospheric systems in the infrasound range, to conducting experiments to investigate acoustic and electromagnetic effects in the atmosphere and ionosphere, to taking terrestrial measurements of electromagnetic signals and echoes caused by acoustic disturbances in the atmosphere, and to assessing the potential for seismographic forecasting based on these signals.

10. An international project entitled "Warnings" focuses on the elaboration of a common scientific programme of experiments. An international scientific committee and an international project implementation group have been formed. The preliminary planning has been completed, work has commenced on the design of scientific equipment, and a space vehicle project (basic space vehicle and two subsatellites) is also being planned.

(b) Astrophysics and extra-atmospheric astronomy

11. As part of the work on the Spektr-UF astrophysical station, the planning and production of structural parts for an astronomical telescope has been completed, and a cooperative international work plan has been agreed upon.

12. For the Koronas-F project, a scientific programme has been elaborated for the processing and interpretation of data received from the Koronas-F station, with assistance being provided in addition in the design of the DIFOS photometer.

13. During the implementation of the Interferometer project, a highly sensitive receiver system in the 325 MHz and 4.8 GHz ranges started operation on the RT-70 radio-telescope in Evpatoria, and a full cycle of radio-astronomical measurements of the characteristics of the antenna and special equipment was taken. Using this equipment, objects within the solar system were localized during the year 2000 by means of very long-base interferometry (VLBI) (results are already available for Venus and Mercury) and the Mitra and 2000CE59 asteroids were investigated by VLBI with the aid of international radio-telescopy networks (RT-70 together with radio-telescopes from China, Poland and the Russian Federation).

(c) Space biology, biomedicine and weightlessness physics

14. The technical specifications, scientific and technical basis and work timetables were drafted for experiments to be conducted on the Radio Sputnik (RS) international space station. A vacuum camera and Luch-1 system were manufactured.

(d) Technological and scientific experiments on an orbital module

15. A coordinating committee for scientific and technological experiments on orbital space stations was set up under the chairmanship of B. Paton, President of the National Academy of Sciences of Ukraine. A competition was held, and 77 of the 250 entries were selected to form the programme for scientific and technological experiments on orbital space stations.

3. Space systems

(a) Space transport

16. Work continued on the design of a new generation of competitive launching systems through the modernization of appropriate standard and converted launch vehicles.

(b) Basic space platforms

17. Work is being completed on the design of a new-generation basic space platform (Mikrosputnik project).

4. Launches

18. During the course of the year 2000, four launch vehicles carrying various satellites were launched:

(a) Zenit-2: two launches for the Russian Federation (3 February and 25 September);

(b) Dniepr-1 (commercial launch): 26 September with Tiungsat, Tegsat, Unisat, Saudisat-1A and Saudisat-1B satellites on board;

(c) Zenit-3SL (commercial launch): 29 July with PAS-9 and 21 October with Thuraya satellites on board.

5. Collaboration with international organizations

(a) Collaboration with international satellite communications organizations

19. The central executive authorities of Ukraine approved amendments to the constituent documents of the International Mobile Satellite Organization (IMSO) and the International Organization of Space Communications (INTERSPUTNIK), and the corresponding draft resolutions for adoption of these amendments were prepared for consideration by the Government (Cabinet of Ministers). The relevant resolution for INTERSPUTNIK was adopted on 5 June 2000.

(b) Collaboration with the Inter-Agency Space Debris Coordination Committee

20. NSAU shares the concern regarding the danger of man-made space debris and regards the problem of removing debris from near-Earth space as being of the utmost urgency. Aware of the global nature of the problem, NSAU joined the Inter-Agency Space Debris Coordination Committee (IADC) in February 2000.

21. Measures are envisaged to prevent littering of near-Earth space in launch vehicles that are in use or currently being modernized or designed in Ukraine.

notably the Zenit-2, Zenit-3SL, Dniepr-1, Dniepr-M, Tsyklon-3 and Tsyklon-4M launch vehicles.

22. Work is being carried out at present under NSAU guidance on preventing fragmentation of the third stage of Tsyklon-3.

23. The Yuzhnoe State Design Bureau actively supports research carried out in other countries into ways of reducing orbiting debris. For example, the Italian satellite UNISAT, which will test new sensors for the experimental registration of collisions between satellites and particles, including microparticles, with different dispersion dimensions, was one of the most important satellites to be put into orbit in the year 2000 by the Dniepr launch vehicle.

24. Ukraine's radio-technological facilities are among the most powerful in the world in terms of their energy potential and hence their ability to observe small objects. The RT-70 system located near Evpatoria is of extreme utility in the study of space debris, since it is capable of detecting particles of just a few millimetres in size at distances of up to 400 kilometres and debris of a few centimetres in size in geostationary orbit.

25. In compliance with the recommendations of the 18th session of IADC, work is being carried out in Ukraine on space debris issues, the results of which should be ready for presentation at the next session of IADC from 19 to 21 March 2001.

(c) Collaboration with the European Organization for the Exploitation of Meteorological Satellites

26. On 17 July 2000 an agreement was signed between the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT) and NSAU on the use of high-resolution data obtained from METEOSAT satellites.

6. Bilateral cooperation

(a) Overview

27. In connection with the signing of cooperative agreements and with planning meetings, joint scientific seminars, conferences and round tables during the year 2000, official delegations visited Ukraine and meetings were held with representatives of diplomatic missions in the country and with aerospace companies and space agencies from Brazil, China, Israel, Japan, the Republic of Korea, the Russian Federation, the United States and Viet Nam.

(b) Collaboration with the Russian Federation

28. Top priority was given to collaboration with the Russian Federation and work connected with the trial operation of the Ukrainian/Russian Okean-O satellite was an important element in the Sich Earth observation system. The system is capable of receiving high-resolution (50 metres) multispectral data using the MSU-V scanner and medium-resolution data (157 x 245 metres) with the MSU-SK, as well as information from radars and radiometers. In this way it can deal with a wide range of tasks in pure and applied fields.

(c) Collaboration with China

29. As a result of bilateral contacts in 2000, a cooperation programme between Ukraine and China was agreed on 19 December 2000 concerning the exploration and peaceful uses of outer space.

7. Exhibitions and educational activities

30. During the year 2000, Ukraine organized or took part in the following aerospace exhibitions and conferences:

(a) EXPO 2000, Hanover, Germany, 21 to 31 August;

(b) AVIAMIR-XXI, Kiev, 14 to 17 September;

(c) Ukraine, Crimean Autonomous Region, New Perspectives International Scientific Conference on the "Role of pilots and cosmonauts in the study of aerospace at the threshold of the 21st century" (as part of World Space Week, declared by the General Assembly based on a recommendation of UNISPACE III), 1 to 5 October.

United States of America

[Original: English]

The *Aeronautics and Space Report of the President: Fiscal Year 2000 Activities* (NASA, Washington, D.C.) will be distributed during the thirty-ninth session of the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space, from 25 February to 8 March 2002.